THE MARINE REVIEW

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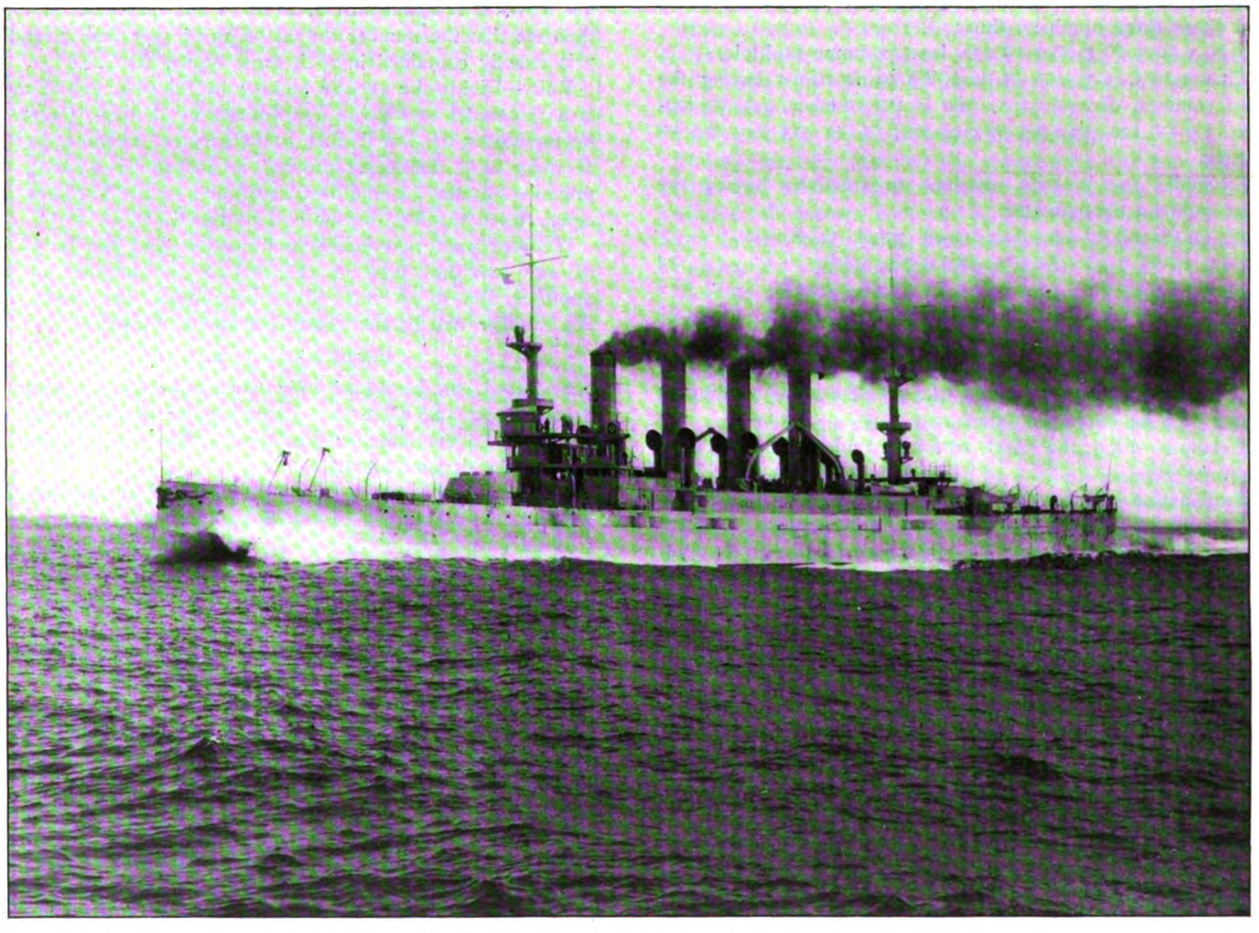
ARMORED CRUISER WASHINGTON'S TRIAL.

The New York Ship Building Co., Camden, N. J., is highly gratified over the performance of the armored cruiser Washington on her recent standardization trial over the Owl's Head course. The fastest mile made by the cruiser was 23.29 knots with the tide. The average for the first five runs on full power was 22.408 knots. The maximum number of revolutions of the engines per minute to produce the top speed was 125.93. The number of revolutions to produce the high rates of speed noted was 124.99. Her speed in the four hours' trial averaged 22.27 knots at 123.88 revolutions per minute. The Washington was sent fourteen times over the measured mile course at varying speeds. A strong wind was blowing diagonally across the course during the trial. The big ship behaved admirably and everything connected with the trial went off without a hitch. The Washington is the first warship to be built by the New York Ship Building Co. The officials of the company on board were: President DeCourcy May; Marine Superintendent W. G. Randle; Chief Engineer Luther D. Lovekin; Chief Naval Architect James Donald and Superintendent of Machinery George M. Andrews. As the contract speed called for 22 knots the performance of the cruiser was in every way gratifying.



STANDARDIZATION TRIAL OF THE ARMORED CRUISER WASHINGTON.

Built by New York Ship Building Co., Camden, N. J. *Copyrighted 1906 by N. L. Stebbins.*

The leading particulars of the vessel are as follows: Length on load water line, 502 ft.; extreme breadth, 72 ft. 10½ in.; mean draught, 25 ft. Her engines are of the four-cylinder triple-expansion type of 23,000 I. H. P. Her main battery comprises four 10-in. guns and sixteen 6-in. rapid fire guns.

SCIENTIFIC LAKE NAVIGATION.

By Clarence E. Long.

Find the least common multiple of 3, 9, 7, 14, 6, 14, 2, 12.

```
2 | 3  9  7  14  6  14  2  12
  ------------------------------
3 |    9        7      6
  ------------------------------
      3        7      2
```

3 is stricken out since it is a factor of 6, which is one of the numbers. 7 is a factor of 14, one 14 is stricken out. 6 is a factor of 12. 2 is a factor of 12. The least common multiple of the remaining numbers, 9, 14, and 12, is to be found.

Divide these numbers by a prime number that is exactly contained in any two of them, bringing down the numbers that are not multiples of the divisor.

Taking 2 as a divisor, bring down 9, and write quotient 7 and 6.

3 being a factor of two of the three numbers, 9, 7, 6, is taken as the next divisor. 3 is written as a quotient, 7 is brought down, 2 is a quotient. As there is no factor common to any two of the numbers, 3, 7, 2, we find the least common multiple by multiplying together the two divisors and these three numbers, thus:

$2 \times 3 \times 3 \times 7 \times 2 = 252$, least common multiple.

Change 1-3, 3-9, 2-5, 7/8 and 8-9 to fractions having the least common denominator. 360 is the number, 1-3 = 120-360; 3-9 = 120-360; 2-5 = 144-360; 7/8 = 315-360; 8-9 = 320-360.

Examples for practice.—Reduce to fractions having the least common denominator.

7/8, 11-16 and 17-24. Ans. 42-48, 33-48, 34-48.

4-13, 15-26, 7-39. Ans. 24-78, 45-78, 14-78.

20-21, 9-56, 5-84. Ans. 160-168, 27-168, 10-168.

6¼, 7-20, 7 and 1½. Ans. 125-20, 7-20, 140-20, 30-20.

When the prime factors of the given numbers cannot be discovered easily by inspection they may be found by the same method as that of finding the greatest common divisor, which will be explained later.

Example.—Find the least common multiple of 255 and 357.

Explanation.—Since the factors of the numbers cannot be readily discovered by inspection, the greatest common divisor is found to be 51, Dividing each of the given numbers by 51, gives the quotients 5 and 7 which are prime to each other. Therefore, $51 \times 5 \times 7 = 1{,}785$, which is the least common multiple of 255 and 357.

```
255 ) 357 ( 1
      255
      ---
      102 ) 255 ( 2
            204
            ---
             51 ) 102 ( 2
                  102
                  ---
```

Therefore, 51 is the G. C. D.

```
51 ) 255  357
     -------
       5    7
```

$51 \times 5 \times 7 = 1{,}785$.

COMMON DIVISORS.

A number that is an exact divisor of two or more numbers is called a *common divisor* of the numbers.

The greatest number that is an exact divisor of two or more numbers is called the *greatest common divisor* of the numbers.

Principle.—The greatest common divisor of two or more numbers is the product of all their common prime factors.

Sometimes the numbers cannot be readily factored. In such cases the following method is employed:

What is the greatest common divisor of 35 and 168?

```
35 ) 168 ( 4
     140
     ---
      28 ) 35 ( 1
           28
           --
            7 ) 28 ( 4
                28
                --
```

Explanation.—The greatest common divisor cannot be greater than the smaller number; therefore 35 will be the greatest common divisor if it is exactly contained in 168. By trial it is found that it is not an exact divisor of 168, since there is a remainder of 28. Therefore, 35 is not the greatest common divisor.

Since 168 and 140, which is 4 times 35 are each divisible by the G. C. D., their difference, which is 28, must be divisible by the greatest C. D.; therefore, the G. C. D., cannot be more than 28. Then 28 must be the G. C. D. if it will exactly go into 35. By trying we find that it does not, but leaves a remainder of 7, so 28 is not the G. C. D. We then see that the number cannot be any larger than 7, and if 7 is exactly contained in 28 it must be the G. C. D.

Rule.—Divide the greater number by the less, and if there is a remainder divide the less number by it, then if there is no remainder the last divisor is the greatest common divisor. If there is a remainder proceed as before by dividing the previous divisor by the last remainder until it comes out equal, when the last divisor will be the G. C. D.

If more than two numbers are given find the G. C. D. of any two and then of the divisor and another of the numbers, and so on until all of the numbers are used. The last number will be the greatest common divisor.

FRACTIONAL ADDITION.

Fractions can be added only when they have a common denominator, and when they express parts of like units.

A common denominator is a number that will exactly contain all the denominators.

The least common denominator is the least number that will exactly contain all of the denominators.

What is the sum of 3/8 and 5/8? Ans. 8-8, or 1 whole one.

Sold 5-15 of a vessel to one man, 7-15 to another and 3-15 to another. How much was sold to all? Ans. 15-15, or the whole of it.

Mary paid $¾ for some ribbon, and $¼ for a pair of gloves. How much did she pay for both? Ans. $1.

Rule for adding common fractions:

Reduce the given fractions to equivalent fractions having the least common denominator, and write the sum of the numerators over the common denominator. Reduce if possible.

Add together ¼, ½ and ⅛, or $¼ + ½ + ⅛ = ?$

First, reduce your denominators to the least common denominator, that is, your least common denominator wants to be some number that each one of the above denominators will be contained in it an equal number of times without a remainder. When you have found this least common denominator see how many times the first denominator is therein contained and with this quotient multiply it by the first numerator, setting it down above the common denominator with a line between them. Do the same with each of the other denominators and numerators, and then add all your numerators together and this sum place over the least common denominator, and this will be the sum or amount

of fractional addition. The above example worked out would be as follows:

¼ + ½ + ⅛ = 2-8 + 4-8 + ⅛ = ⅞, or the explanation is as follows: 8 is the least common denominator, because it is common to each of the denominators, that is each one of the denominators is contained in 8 an equal number of times; now, there isn't any difference between 2-8 and ¼, neither is there any difference between 4-8 and ½; then, 4 into 8 twice and 2 times 1 are 2; 2 into 8, 4 times and 4 times 1 are 4, and 8 into 8 once and 1 times one is 1.

A man having 2-5 of a ton of coal bought 2-3 of a ton more. How much had he then? Ans. 16-15, or 1 1-15 tons.

Henry gave $⅜ for a book, $¼ for a slate and $2-3 for a bottle of ink. What did he pay for all? Ans. $31-24. or $1 7-24.

What is the sum of ½, 1-3 and 5-6? Ans. 10-6 or 1 2-3.

When there are mixed numbers, or whole numbers, add the fractions and whole numbers separately, then add the results.

What is the sum of 14¾, 25⅞ and 7⅝?

8 is the least common denominator.

14¾ = 14 6-8
25⅞ = 25⅞
7⅝ = 7⅝

46 + 18-8 = 48¼.

A vessel sailed NE 16 22-3 miles; N x E 12⅜ miles and NNW 17 4-5 miles. How many miles did she sail in all? Ans. 46 101-120 miles.

Find the sum of 2-5, 7-12 and 4-15. Ans. 1¼.

Find the sum of ¾ and 3½. Ans. 4¼.

Find the sum of 5 1-3 and 7-9. Ans. 6 1-9.

Find the sum of 15½ and 5-3. Ans. 17 1-6.

Find the sum of 5-12, 13-15 and 7-20. Ans. 1 19-30.

Find the sum of 42, 31 5-12 and 9 7-18. Ans. 82 29-36.

⅝ + 6 7-12 + 21 5-6 + 77 = ? Ans. 106 1-24.

15-48 + 11-16 + 7⅜ + 60 + 75-96 = ? Ans. 69 5-32.

What number is that from which if 24 4-7 is taken the remainder is 63 22-35? Ans. 88 1-5.

A farm is divided into 4 fields: the first contains 29 7-12 acres, the second 50 16-21 acres, the third 41 6-7 acres, and the fourth 69¾. How many acres in the farm? Ans. 191 83-84 acres.

FRACTIONAL SUBTRACTION.

The rules for subtracting common fractions are just the same as those of addition of fractions, except that you subtract in place of adding.

Fractions can be subtracted only when they have a common denominator; and when they express parts of like units. When there are mixed numbers subtract the fractional and whole parts separately and add the results.

If the mixed numbers are small they can be reduced to improper fractions, and subtracted according to the usual method. Reduce when possible.

What is the difference between 3-12 and 7-12? Ans. 4-12, or 1-3.

A man who owned a steamer sold 5-16 of it. What part did he still own? Ans. 11-16.

If a ton of coal cost $7 1-3 and a cord of wood $4 4-5, what is the difference in their cost? Ans. $2 8-15, found thus:

22-3 — 24-5 = 110-15 — 72-15 = 38-15 = $2 8-15 Ans.

From 134⅛ take 76⅝. Ans. 57 17-24.

From 7-9 take 4-15. Ans. 23-45.

A farmer having 208 acres of land sold 92 7-25 acres. How many acres had he left? Ans. 115 18-25.

From 9-14 take 16-63. Ans. 7-18.

Find the difference between ⅝ and 3-11. Ans. 31-88.

From 36 5-7 take 10½. Ans. 26 3-14.

What number added to 307 1-7 + 210¾ will make 700⅝. Ans. 182 41-56.

What fraction added to the sum of ⅛, 5-12 and 5-18 will make 133-144? Ans. 5-48.

A man bought a ton of hay for $15⅜, a barrel of flour for $9 5-12 and a barrel of apples for $3 7-16. What change should be given to him for three ten dollar bills? Ans. $1 37-48.

Cancellation.

Cancellation is the process of shortening operations in division by rejecting equal factors from both dividend and divisor, and is used to great advantage both in multiplication and division of fractions, so as not to have such large denominations to multiply by. For example:

Multiply ¾ × 8-9 × ⅞ × ½ × 3-21 = ?

Multiplying it out in full it would stand thus: ¾ × 8-9 × ⅞ × ½ × 3-21 = 504-12096, which reduced to its lowest terms is 1-24. but by cancellation we get the same result with much less work; thus:

$$\frac{1 \times 1 \times 1 \times 1}{3 \times 8 \times 7 \times 1 \times 3} = 1\text{-}24$$

$$\frac{4 \times 9 \times 8 \times 2 \times 21}{3 \times 3}$$

We know that rejecting equal factors from both dividend and divisor does not change the quotient and we know that the numbers above the line are the dividends and the ones below the line the divisors.

Rule.—Cancel all the factors common to the dividend and divisor. Divide the product of the dividend by the product of the remaining factors of the divisor, and the result will be the quotient.

FRACTIONAL MULTIPLICATION.

Rules.—Multiply together the numerators, for new numerators; and denominators for new denominators.

Cancel all factors common to numerators and denominators before multiplying, thus shortening the operation and obtaining the answer in its lowest terms.

Reduce all whole and mixed numbers to improper fractions.

To multiply a whole number by a fraction, or a fraction by a whole number, make a fraction of the whole number—the whole number to be the numerator, and the figure 1 in all cases to be the denominator, thus the fraction of 5 would be 5-1.

To multiply a mixed number by a whole number, multiply the whole numbers and the fraction separately and add their products, thus, 2½ × 3 = 7½, or the explanation is as follows: 2 times 3 are 6 and 3 times ½ in 1½, which added to 6 makes 7½.

Note.—Mixed numbers multiplied by whole numbers can also be worked by making improper fractions of each number, thus 2½ × 3 would be 5-2 × 3-1 = 15-2 = 7½.

Mixed numbers multiplied by mixed numbers must first be reduced to improper fractions, thus, 5¼ × 2 2-3 would be

$$\frac{7 \quad 2}{21 \times 8} = 14 \text{ Answer.}$$

$$\frac{}{4 \quad 3}$$

To multiply a fraction by a fraction multiply numerators for new numerators, and denominators for new denominators.

The word *of* between fractions is equivalent to the sign × of multiplication.

To multiply a mixed number by a fraction, first convert the mixed number into improper fraction and then multiply numerators together for new numerators and denominators together for new denominators.

Multiply 7-75 by 15 = 105-75, found, thus:

Long operation:

7-75 × 15-1 = 105-75, which reduced is 1 2-5.

Short operation—cancellation:

$$\frac{7 \times 15}{75 \times 1} = 7\text{-}5 = 1\ 2\text{-}5.$$

Multiply 45-120 by 36 =

$$\frac{9 \times 3}{120 \times 1} \quad \frac{45 \times 36}{10} = 27\text{-}2 = 13\tfrac{1}{2}.$$

Multiply 127 2-3 by 12 = 1,532.

$$\begin{array}{r} \times\ 12 \\ \hline 254 \\ +\ 127 \\ \hline 1{,}524 \\ 8\ + \\ \hline 1{,}532 \end{array}$$

$12 \times 2\text{-}3 = 24\text{-}3 =$ Ans.

Here is the same example reduced to improper fractions:

$127\ 2\text{-}3 \times 12 = 383\text{-}3 \times 12\text{-}1$

$$\frac{383 \times 12}{3 \times 1} = 1{,}532$$

Multiply $2\frac{1}{2}$ by 3 1-5 =

$$\frac{5 \times 16}{2 \times 5} = 8 \text{ Ans.}$$

Multiply 7 1-3 by $1\frac{3}{4}$ =

$$\frac{11 \times 22 \times 7}{3 \times 4 \times 2} = 77\text{-}6 = 12\ 5\text{-}6 \text{ Ans.}$$

Find the result of 16 — 3-10 × 12 2-3 = ?

16 = 15 10-10 and minus 3-10 leaves 15 7-10 multiplied by 12 2-3 = 198 13-15. Reducing both to improper fractions we have:

$$\frac{157 \times 19}{10 \times 38 \times 3} = 2983\text{-}15 = 198\ 13\text{-}15.$$

$\frac{1}{2}$ of $\frac{1}{2}$, or $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

$\frac{1}{4}$ of $\frac{1}{4}$ = 1-16; $\frac{1}{8}$ of $\frac{1}{8}$ = 1-64; 1-3 of $\frac{1}{4}$ = 1-12; 2-5 of 2-3 = 4-15.

What part of a mile is 3 times $\frac{1}{4}$ of a mile? Ans. $\frac{3}{4}$ of a mile, thus 3 times the numerator 1 is 3, or $\frac{3}{4}$.

If a steamer runs 12 miles an hour how far will she run in 4-5 of an hour? Ans. 9 3-5 miles; thus, 12 × 4-5 = 48-5, or 9 3-5 miles.

What costs 9 pounds of butter at $\$\frac{3}{8}$ a lb? Ans. $\$3\frac{3}{8}$.

Note.—Remember to reduce all whole and mixed numbers to improper fractions.

Rule.—To reduce a whole number to an improper fraction: place the whole number at the top and the figure 1 below with a line between them, that is, make the whole number the numerator and the figure 1 the denominator; thus, 12 would be 12-1.

To reduce a mixed number to an improper fraction, multiply the denominator of the fraction by the whole number and add in the numerator of the fraction; make this sum the numerator with the same denominator as the fraction, placing a line between them. Thus, $5\frac{3}{8}$, is 8 × 5 = 40 + 3 = 43-8.

At $12 a ton what will $5\frac{3}{8}$ tons of coal cost? Ans. $\$64\frac{1}{2}$.

What will 7 2-3 weeks' board cost at $9 a week? Ans. $69.

If an acre of land produces 45 bushels of corn, how much will 2-3 of an acre produce? Ans. 30 bushels.

Multiply 5-14 by $\frac{7}{8}$ = 5-16

2-3 × $\frac{3}{4}$ = $\frac{1}{2}$

How much is 5-6 of $7\frac{1}{2}$ miles? Ans. $6\frac{1}{4}$.

Multiply 11-24 by 36-57. 11-38.

Find the product of 7-16 × 4-21 × 5 1-3 = 4-9

Find the cost of 15 cords of bark at $\$4\frac{5}{8}$ a cord. Ans. $\$69\frac{3}{8}$.

When possible use cancellation.

A wheel in making one revolution travels 15 3-10 feet. How far will it travel in making 25 revolutions? Ans. $382\frac{1}{2}$ feet.

If a ship sails 18 5-9 miles an hour, how far will she sail in 15 hours? Ans. 278 1-3 miles.

FRACTIONAL DIVISION.

Rule.—Multiply the dividend by the divisor inverted. Whole numbers and mixed numbers must be reduced to improper fractions.

Rule for dividing common fractions: Invert the terms of the divisor, that is, turn it bottom side up; the denominator then becomes the numerator and the numerator the denominator. After inverting the divisor proceed as in multiplication of fractions, that is, multiply numerators together for new numerators and denominators for new denominators; thus, 3-10 divided by $\frac{1}{8}$, or 3-10 multiplied by 8-1 equals 24-10, and 24-10 equals 2 2-5. Prove this by multiplying the quotient and divisor together to get dividend; thus, 2 2-5 multiplied by $\frac{1}{8}$, or 12-5 × $\frac{1}{8}$ = 12-40 and 12-40 reduced is 3-10, or 4 into 12, 3 times and 4 into 40, 10 times.

Remember what has been said about improper fractions. In dividing mixed numbers make improper fractions of them in the first place. For example, divide $6\frac{3}{4}$ by $2\frac{1}{8}$. Proceed thus, 4 times 6 are 24 and 3 added are 27-4; now 27-4 is the same as $6\frac{3}{4}$, because it takes 4-4 to make a whole one. Do the same with $2\frac{1}{8}$, which is 17-8, then invert the divisor 17-8, which becomes 8-17, and then multiply, thus:

27-4 × 8-17 = 216-68 = 3 12-68, or 3 3-17. Prove this:

$$\frac{54 \times 17}{17 \times 8 \times 4} = 27\text{-}4, \text{ or } 3\tfrac{3}{4}.$$

The most important matter for the student to remember in division of fractions is the divisor. You should thoroughly understand what the divisor is in every case, so don't lose sight of it in what is to follow.

$\frac{3}{4}$ divided by 3 = $\frac{1}{4}$ found thus, (remember 3 is the divisor) $\frac{3}{4} \div 3\text{-}1$, or $\frac{3}{4} \times 1\text{-}3 = 3\text{-}12 = \frac{1}{4}$. 3 divided by $\frac{3}{4}$ = 4. Here the conditions are just the reverse, $\frac{3}{4}$ being the divisor, $3 \div \frac{3}{4}$, or $3\text{-}1 \times 4\text{-}3 = 12\text{-}3 = 4$.

Divide $\frac{7}{8}$ of a barrel of flour equally among 3 families. What part of a barrel will each family receive? $\frac{7}{8} \div 3\text{-}1 = \frac{7}{8} \times 1\text{-}3 = 7\text{-}24$ Ans.

Divide 180 by 8-15. Ans. $337\frac{1}{2}$.

A man gave 503 acres of land to his sons, giving them 83 5-6 acres apiece. How many sons had he? Ans. 6 sons.

Paid $\frac{1}{8}$ of $64 for 1-7 of $17\frac{1}{2}$ cords of wood. What was the cost per cord? Ans. $3 1-5. Found thus: $\frac{1}{8}$ of $64 is $8 and 1-7 of $17\frac{1}{2}$ cords is $2\frac{1}{2}$ cords and 8 divided by $2\frac{1}{2}$ = $3 1-5.

If a vessel logs $38\frac{1}{2}$ miles in $3\frac{1}{2}$ hours, how many miles is she making per hour? Ans. 11 miles an hour; $38\frac{1}{2} \div 3\frac{1}{2}$, or

$$\frac{11 \times 1}{77 \times 2} = 11\text{-}1$$
$$2 \times 7$$
$$1 \times 1$$

If a vessel logs 137 miles in 11¾ hours, what number of miles is she logging per bour? Ans. 11 31-47, about 11 2-3 miles.

137 ÷ 11¾ = 137-1 × 4-47 = 548-47 = 11 31-47.

If it takes your boat ¾ of an hour to run 7¾ miles, what rate of speed are you making per hour? Ans. 10 1-3 miles per hour; found thus,

7¾ ÷ ¾, or $\frac{31 \times 4}{4 \times 3} = 31\text{-}3 = 10\ 1\text{-}3$ miles.

Proof: ¼ of (10 1-3) 31-3 (¼ × 31-3 = 31-12) = 2 7-12 miles in ¼ of an hour; 2 7-12 × 3, or 31-12 × 3-1 = 93-12 = 7¾ miles. The explanation is as follows: If she makes 10 1-3 miles in one hour, in one-fourth of an hour she will make ¼ of 10 1-3 which is 2 7-12 miles, and in ¾ of an hour she will make 3 times 2 7-12 miles, which is 7¾ miles.

If it takes your boat 21½ minutes to run 3¾ miles, how fast is she running per hour? Ans. 10 20-43 miles per hour, found thus, 21½ ÷ 3¾, or

$$\frac{\times 2}{43 \times 4} = 86\text{-}15 = 5\ 11\text{-}15 \text{ minutes to make one mile.}$$
$$2 \times 15$$
$$1 \times$$

60 minutes in one hour, therefore, 60 ÷ 5 11-15 is 60 × 15-86 = 900-86 = 10 20-43 miles she would make in one hour.

If your boat makes 11¼ miles an hour how long will it take to run from Chicago to Pt. Betsey, the distance being 203 statute miles? Ans. 18 2-45 hours, or 18 hours and 3 minutes, nearly.

It takes your boat 9 3-5 hours to run 98⅜ miles, how far will she run in one hour? Ans. 10 95-384 miles.

Divide ⅞ by ¾. Ans. 1 1-6.

THE SUBJECT OF DEVIATION.

Editor Question Dept.: I either don't understand Mr. Long or else I am mixed up in my ideas of deviation. In his article under date of April 5, headed "What Every Master Should Know," near the bottom of the second column he makes the statement: "Dev. taking no part in the problem, because it remains the same for that heading of the vessel whether in the Sault river or on Lake Superior, providing, however, that the change of latitude is not too great." Now, where I don't agree with Mr. Long is where he says that Dev. remains the same on that heading whether on the Sault river or Lake Superior—the Dev. is hardly ever the same in the same place, different conditions such as different kinds of cargo, different trim of the vessel, with water ballast in or without water ballast, all of the different conditions tend to change the Dev. either to increase or decrease it. On my first trip up Lake Superior this spring, I found on the course from Eagle Harbor to Devil Island that my compass had ⅞ of a point easterly Dev. after allowing Var. This result I got by using the pelorus. On my return trip I found ⅝ point easterly Dev. Then I may get a cargo of iron ore which has a greater or less percentage of iron in it that will again make a difference in the Dev. I notice this time up on Lake Huron that I had less Dev. than last trip up between Ft. Gratiot and Sanilac, heading N. ¼ E. by compass pelorus showed N. Mag. This time there was no Def. N. and compass was N. Mag. under practically the same conditions, no wind, water ballast out of Nos. 1 and 2 tanks.

Now, if I have made a mistake I want to know where it is. I use the pelorus constantly and so far have had good success with it. I don't think there is a place in the world where piloting is any nearer a science than on the great lakes, where conditions are so varied and changeable. A thorough knowledge of Dev. and its causes is certainly very essential to the lake masters, but when it gets thick like some of the days we had last year, and the master don't know what his Dev. is—possibly has not had a chance to find out—there is where he is "up against it" strong. Take a boat lying idle all winter, say near a big pile of iron ore, or alongside of several other boats for over three months. Her compass can't be in very good shape in the spring, and it will take several trips for that compass to get its bearings. The Dev. will be constantly changing. I know this by experience. I would like to have Mr. Long tell me whether I am right or where my mistake, if any, is. I am very much interested in his articles and am absorbing all I can get of them, and they are to be a great help to us all.

E. L. SAWYER, Master Steamer Griffin.

EFFICIENCY OF SUBMARINE SIGNALS.

The Submarine Signal Co., 247 Atlantic avenue, Boston, exhibits the following letter sent to Vernon H. Brown, agent of the Cunard Line, by Capt. James B. Watt, of the steamer Lucania:

"Re submarine signal—I beg to report as follows:

"We had hazy weather with showers of misty rain off the Nantucket shoals and we would have failed to locate the light vessel but for the aid of the submarine signal bell. We heard it 8½ miles distant whilst steaming full speed, 22 knots, on the starboard bow, or side, thus - - -, two strokes, a short interval, then one stroke. The ship's course was altered to the northward just so that the sound of the bell could not be heard on the port side. We made the light vessel one point on the starboard bow and passed it one-third of a mile off which enabled us to obtain a good departure. The sound of the bell was musical and distinctly audible and could not be mistaken for any other sound. To my mind this is a very satisfactory experience as it brings home to one the practicability of the system."

The following letter was also submitted by Capt. C. Kaempff, of the steamer Deutschland:

"Left Cuxhaven on Jan. 18, 4.20 P. M. The wind was S. W., strength 4-6, the weather rainy and thick. The observation was begun at the Elbe V. The first evidence of a sound was heard one knot inside of the H lightship and at a distance of 5½ knots. At first it was heard good and clear on the port side, but it could no longer be heard when the lightship I was dead ahead. With the rudder to starboard the ship was turned more to port, about four degrees, when almost immediately the four strokes of the bell were heard clearly again. At first the sound was without any ring, but on approaching nearer, the sound became good and full. It could still be heard until about three knots astern, one point on the port. In the opinion of all, the former perceptible ship's noises had disappeared and only the rush of the water was noticeable. Unfortunately, on account of the difficulty of maneuvering as a result of the thick weather and the great amount of traffic at the time in the neighborhood of the lightship, the apparatus on the starboard side could not be tested. The bell on the Weser lightship could not be heard when passing, at about 6.42 P. M., three to five knots distant."

B. L. Dimon and J. R. Rowland, two officials of the Joy line, have been appointed vice president and general manager and traffic manager respectively of the Brunswick Steamship line, which is to be operated between Brunswick, Ga., New York, and Boston, as soon as its vessels are completed.

THE CONDITION OF BRITAIN'S SHIP BUILDING TRADE.

While reports from ship building districts indicate a falling off in the booking of orders for new steamers, the return just issued by Lloyds registry shows that the amount of work on hand is within a small fraction of the highest total reached in the history of the industry, so that for the present, workers need not be anxious. But it would be a mistake to place too much reliance for the future on the figures now issued. The greatest amount of work ever recorded by Lloyds was in September, 1901, when the total tonnage was 1,413,000 tons; now the 547 vessels in course of construction make up 1,401,882 tons, so that we are within 12,000 tons of the maximum. It is specially gratifying, too, to note that of the work 435,000 tons has only been commenced during the past three months, while 368,000 tons of shipping was launched in the same quarter. Thus the rate of ordering vessels has been greater than the rate of launching. The aggregate has been steadily going up since December of 1903, and, as compared with three months ago, the augmentation is 46,000 tons, on six months ago, 76,000 tons, and on a year ago, 150,000 tons. This gain, as compared with April last year, is widely distributed. At Glasgow, where 116 vessels, of 290,829 tons, are being built, the addition is 55,000 tons. In the neighboring port of Greenock the improvement is at an even greater ratio, from 181,641 to 238,007 tons. Newcastle has only added 10,000 tons, the 92 vessels now on the stocks representing 265,547 tons. At Sunderland there is a decrease of 2,500 tons, the figure now being 187,766 tons. The Tees total of 95,245 tons is 18,500 tons up, and the Hartlepool total of 84,620 tons is 15,000 tons greater. Belfast, like Sunderland, has less tonnage than in April last year, the total now—171,130 tons—being 21,000 tons down. Here, at a glance, is the condition as compared with a year ago:

	1906.		1905.	
	No.	Tons.	No.	Tons.
Merchant ships	547	1,401,861	474	1,251,343
H. M. ships in private yards..	38	118,075	30	109,490
H. M. ships in dock yards	8	124,400	8	119,950
Foreign warships	9	55,420	5	33,230
Total	602	1,699,777	517	1,514,013

The increase in foreign warship work is gratifying, but Lloyd's figures include the two battleships for Japan which are to go on their trials this month. Two years ago the total tonnage of all vessels was 472, of 1,365,779 tons.—*Engineering*, London.

FOR THE DEFENSE OF BRITAIN.

The managers of the White Star American, Dominion, Atlantic Transport, and Leyland lines have decided to make an important move in the interest of the defences of Britain, and the patriotism thus displayed is being much applauded. They have decided that all those who are on the salaried lists in these companies' various offices, and who are members of any of the auxiliary forces shall have precedence over all others in the matter of holidays, but, in addition to this preference, which is itself a very great consideration, it has been arranged that they shall have an extra week's leave on full pay, both concessions being absolutely dependent upon attendance at each annual camp meeting for training. When it is realized that these companies have on their salaried list a staff of approximately 600, some conception can be formed of the number of clerks and others who may benefit by this action, and perhaps some who do not already encourage their employes to join the auxiliary forces will be influenced to follow the example set by the managers of the lines just referred to. These lines, it is interesting to add, are controlled by the International Mercantile Marine Co.

GERMANS HAVE FASTEST SHIPS.

An official German report which has just been issued regarding the respective speeds of steamships carrying the mails between Great Britain and America shows the marked superiority of the German liners over their British rivals. The figures given refer to the twelve months ending June 30, 1905, so that the performances of the latest fast German steamships are not taken into consideration. During the twelve months ending June, 1905, the North German Lloyd steamships Kaiser Wilhelm II, Kronprinz Wilhelm, and Kaiser Wilhelm der Grosse made nine, ten, and eleven trans-Atlantic trips respectively, which enabled the mails to be conveyed from New York to London in the average times of 149.5 hours, 150.9 hours, and 152.5 hours respectively. The quickest conveyance of mails from New York to London by each steamer occupied only 144.1 hours, 145.6 hours, and 146.3 hours respectively. The performances of the Hamburg-American liner Deutschland were equally good. This steamer made eight trans-Atlantic trips, which enabled the mails to be conveyed from New York to London in an average time of 150.6 hours, the quickest conveyance of mails occupying only 147.2 hours. The steamers of the Cunard line were in most cases almost a day behind their German rivals. The best trips were made by the Campania, which, in twelve trans-Atlantic voyages enabled the mails to be conveyed from New York to London in an average time of 167.6 hours, the quickest passage occupying 163.4 hours. The Lucania is the only one of the remaining five Cunard fast steamships which can show a similar record. The fastest steamship of the White Star line, the Oceanic, made eleven trans-Atlantic trips, and conveyed the mails from New York to London in an average of 165.1 hours, the quickest conveyance being 163.4 hours. The next best White Star liner showed an average of 185.2 hours from New York to London. The fastest steamer of the American line, the Philadelphia, had an average time of 177.6 hours.

EMPRESS OF BRITAIN SPEEDY.

The new twin-screw steamer Empress of Britain, the first of the two vessels ordered from the Fairfield Ship Building Co. for the North Atlantic service of the Canadian Pacific Railway Co., seems to have done extremely well on her trials in the Clyde just recently. She attained a speed of 20 knots, which is sufficient proof that in this vessel the Canadian Pacific Railway Co. will have a very fine boat for carrying on the mail service between Great Britain and Canada in conjunction with the Allan line. The sister ship, the Empress of Ireland, will probably run her trials in a few weeks' time, and consequently will not be much behind the Empress of Britain, which is to leave Liverpool on May 5 for her first voyage to Canada. The two Empresses of the Canadian-Pacific Railway Co. will be associated for the purposes of accelerated mail and passenger carriage with the Allan line turbine steamers Victorian and Virginian. The four vessels between them will conduct a fast weekly mail service. The Allan boats are of some 2,500 tons less dimensions than the new Empresses, but they have already attained great popularity owing to the comfort which the turbines assume dring the ocean voyage. The Virginian, which, like her sister ship, is triple-screwed, has already made a record in the trip to Halifax, her time being 6 days 11 hours. It is something new to leave Liverpool on one Thursday and land in a Canadian port from a Canadian mail boat on the succeeding Thursday, yet this looks like being an every-day achievement before long.

The new turbine steamer now being fitted with machinery at the yard of the W. & A. Fletcher Co., Hoboken, N. J., will be equipped with twelve pumps of the Blake pattern by the International Steam Pump Co.

THE BELLEVILLE BOILER.

A meeting of the Institute of Marine Engineers held in London on April 23, was noteworthy from the fact that a paper on "The Belleville Boiler" was read by Mr. F. J. Kean, B. Sc. Mr. Kean in the course of his paper said that probably only those who had been actually engaged upon the construction of Belleville boilers or had gone to great trouble in searching through back numbers of periodicals and engineering text books would be able to follow very closely what was the precise nature of the questions at issue. In the first place, they had to find out how it came about that the Belleville boiler was adopted as the standard pattern of steam generator for the British navy. Although the cylindrical type of marine boiler had always proved itself a good servant in practice, still it had one or two features which were undesirable from a naval point of view. The chief objections against it were its large size and its slow steaming properties, which were due to the large quantity of water that it contained. When the importance of having a quick steaming boiler first became apparent, the only type of boiler in existence which looked any thing like the right sort was the water tube boiler designed by M. Belleville. There did not appear to have been any other type which had been tested under working conditions at that particular time, and which had proved so satisfactory; hence the admiralty adopted this boiler as their standard type, and caused it to be fitted on board a large number of Britain's largest warships.

THE BOILER DESCRIBED.

The Belleville boiler of today, continued Mr. Kean, consisted of two principal parts—(1) the generator or boiler proper, and (2) the economizer or feed water heater. The generator was formed of a number of sets of tubes placed side by side over a fire grate with a steam drum fastened across the top, and a water collector across the bottom. The generator was so placed that the bottom tube of each set, or element, was about two feet above the bars of the fire-grate. Just above the top row of tubes there was a free space which was called a combustion chamber, and then above that came the economizer. The economizer was arranged in a similar manner to the generator, and had a cold water collector across the bottom, and a hot water collector across the top. The passage of the flames and hot gases on their way up through the tubes was guided by baffle plates and they met together in the combustion chamber preparatory to passing up through the economizer, whence they passed away up the funnel.

ITS DEFECTS.

It was in the year 1903 that a special committee which had been appointed by the British admiralty to inquire into the working of the Belleville boiler in the ships of the Royal Navy, and to report as to a suitable type of boiler to be fitted in future warships, presented its report. The report contained an account of a series of trials on two vessels, the Hyacinth and Minerva, which were specially selected for the purpose, the Hyacinth having Belleville water tube boilers and the Minerva cylindrical return-tube boilers. Among the defects which were noted in the Belleville boilers were the following: (1) The circulation was defective and uncertain; (2) an automatic feeding arrangement of a delicate and complicated kind was absolutely necessary for the safe working of the boilers; (3) the great excess of pressure over that in the boilers which was required in the feed pipes and pumps; (4) the considerable excess of boiler pressure over that at the engines; (5) a separator with an automatic drain was required to get rid of the water carried over from the boilers when any sudden excessive demand for steam was made; (6) there was a constant and excessive loss of feed water. Mr. Kean then referred in detail to certain of the disadvantages of the boiler.

ITS ADVANTAGES.

Coming to a consideration of the advantages, Mr. Kean said the Belleville boiler was superior to the cylindrical boiler in the following properties: (1) It had a higher thermal efficiency; (2) it raised steam quicker; (3) it was not so heavy. It would be sufficient to state that steam could be raised from "all cold," in about 40 minutes in a Belleville boiler, to show that the boiler was a very rapid steamer. There was perfect freedom from injurious strains, because the tubes were quite free to expand in every direction. It was astonishing how deceptive the weight of a Belleville plant was. One would naturally expect that when only such a small quantity of water was contained in it, the boiler would be extremely light, but it was the weight of the fire-brick settings, the separator, the air-blowing engines, etc., which had all to be taken in account, so that compared as a whole with an ordinary boiler equipment, the saving in weight was greatly reduced. As an off-set against the above advantages must be set the disadvantages already named, together with the fact that the management of the Belleville boilers required far more skill and experience than cylindrical boilers. Even the government contractors found it advantageous only to employ those men who had had previous experience in that class of work in order to facilitate the erections of those boilers in the shop as well as on board ship. The coupling-up of mud-drums to down cast pipes and feed collectors was a job which called for men of great skill if it was to be done expeditiously. Another thing to note was the large amount of spare gear required for a Belleville plant compared with that for an equally powerful cylindrical boiler plant. Each boiler had to have at least one complete spare element for the generator, and one for the economizer, because it was found to take far less time to put in a complete element, than to replace a damaged tube. Then, in addition, they had spar rings, sleeves, nipples, tubes, float gear, etc. An interesting discussion followed the reading of the paper.

SHIP BUILDING DURING APRIL.

The bureau of navigation reports eighty-one sail and steam vessels of 17,136 gross tons were built in the United States and officially numbered during the month of April, 1906, as follows:

	WOOD				STEEL		TOTAL	
	Sail		Steam		Steam			
	No.	Gross	No.	Gross	No.	Gross	No.	Gross
Atlantic and Gulf	6	382	39	1,984	2	3,804	47	6,170
Porto Rico	....	....	....	....	....	....	....	....
Pacific	1	41	14	1,003	....	....	15	1,044
Hawaii	....	....	....	....	....	....	....	....
Great Lakes	....	....	5	162	3	15,067	8	15,229
Western Rivers	....	....	11	693	....	....	11	693
Total	7	423	69	3,842	5	18,871	81	23,136

The navy department will remove all penalties which have been standing against the Union Iron Works of San Francisco for delay in the construction of the armored cruisers California, South Dakota and Philadelphia. This action on the part of the navy department is both gratifying and commendable.

At the recent meeting of the board of directors of the Harlan & Hollingsworth Corporation, Wilmington, Del., the following officers were elected: Wm. G. Coxe, president; Persifor Frazer, Jr., vice president; Henderson Weir, secretary and treasurer; Samuel K. Smith, assistant secretary and treasurer.

The dry dock Dewey, enroute to the Philippines, passed through the Suez canal on May 1.

THE MARINE REVIEW

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MAY 10, 1906.

SHIPPING BILL INDORSED.

When resolutions are adopted both by employer and employed urging a common policy it may be reasonably assumed that that policy meets with the consent of the whole people. Such an endorsement has been given to the shipping question during the past week, one by the United Boilermakers and Iron Ship Builders of North America, an organization embracing thousands of workmen, and the other by the Builders' Exchange of Cleveland, an organization employing thousands of workmen. It is reasonable to suppose that if everyone else in the country had studied the shipping question as thoroughly as these two bodies have they would have a like opinion. The great trouble with the shipping question in the past has been that a considerable portion of the country has considered it remote to their business. As a matter of fact, it is intimately associated with every business in the United States. Thanks to the Merchant Marine Commission, which made an exhaustive tour of the country two years ago, the truth of this assertion is being brought home to the people. More endorsements have been secured for shipping during the past year than ever before. It has been earnestly recommended by merchants, manufacturers, bankers and farmers. It has received the unequivocal support of the manufacturing and agricultural interests of the country. The resolutions adopted by the Builders' Exchange and by the United Boilermakers and Iron Ship Builders are herewith printed in parallel columns to prove that both capital and labor are reaching the same goal, though they approach it from different directions.

BY CAPITAL.

Whereas, With the phenomenal growth of our great national industries, for forty-five years there has been a steady decline in our shipping in the foreign trade, the subject having been thoroughly investigated during the past two years by a commission appointed by congress for that purpose, pursuant to the president's suggestion, the commission rendering a report, accompanied by a bill to carry into effect the recommendations contained in said report, the enactment of which bill, which passed the United States senate on February 14, 1906, we believe will cause a great and permanent upbuilding of our deep sea shipping; therefore be it

Resolved, That the Builders' Exchange, of Cleveland, Ohio, solicitous for the upbuilding of our foreign-going shipping, for its expansion and prosperity, and believing that a marine of our own will relieve us of an unstable dependence upon foreign shipping for the marketing of our exports, will keep in our own channels of trade many millions annually now paid to foreigners for doing our foreign carrying, and will prove a necessary and invaluable resource for the army and navy in time of war, heartily approves of the Merchant Marine Commission shipping bill and strongly urges its adoption by the house of representatives; and be it further

Resolved, That a copy of this resolution be sent to each senator and representative in congress from the state of Ohio.

BY LABOR.

Whereas, The revival of American ship building for the foreign trade, provision for which is made in the Merchant Marine Commission shipping bill, which passed the United States senate on February 14, 1906, and is now in the hands of the House Merchant Marine and Fisheries Committee, would be of immediate and permanent benefit to American labor, especially that employed in ship building, in which industry it has been truthfully said that "all trades are united," and

Whereas, If American ship yards should be employed in replacing with American vessels the five millions of tons of foreign shipping now employed in the foreign trade of the United States, there would be better hours, better pay and continuous employment for all of those engaged in ship building or its allied industries, for a great many years to come, assuring such a permanency in the ship building business in the United States as to eventually give this country front rank in this great industry, therefore be it

Resolved, That the United Boiler Makers and Iron Ship Builders of North America in convention assembled most heartily indorse the Merchant Marine Commission shipping bill, and most earnestly urge upon every representative in congress his active and patriotic support of that measure, as in the interest of the national defense, for the greater stability of our foreign carrying, and as in the interest of American labor; and be it further

Resolved, That a copy of these resolutions be forwarded to the chairman of the House Merchant Marine and Fisheries Committee, over the seal of this association and the attestation of the secretary.

The shipping bill drafted by the Merchant Marine Commission has passed the senate. It ought to pass the house and be made a law before the present congress adjourns. The bill affords one of the most convenient remedies for a situation which, if permitted to continue, must inevitably destroy the over-sea marine of the United States. It is one thing to determine that a patient is ill; it is another thing to devise a remedy for his ailment. The present bill, however, outlines a distinct remedy by the diversion of tonnage taxes to American ships for services outlined in the bill and directly rendered. The American ship, of course, would pay its own tonnage tax the same as the foreign ship, but as only 9 per cent of our commerce is at present carried in American ships, it follows that 91 per cent of the tonnage taxes would be paid by foreign ships. The bill proposes to divert the tonnage tax fund to the American ship for services rendered in carrying the mails, in opening up new trade routes and in developing a naval reserve. Of course, as the American marine developed in the foreign field, it would pay a greater proportion of the total tonnage tax, but it is hoped that by the time it is paying half of the total tonnage tax it will have so strengthened itself as to meet the foreigner in open competition.

At any rate the plan is well worth trying and the bill should be passed.

LONGSHOREMEN'S STRIKE IS ENDED.

The longshoremen's strike is a thing of the past. It has been called off by President Keefe and all the locals have been wired to resume work. There will for the next two weeks be much congestion at Lake Erie docks, as all the vessels that arrived from upper lake ports during the past ten days have been riding at anchor outside Lake Erie ports. There is about 1,500,000 tons of ore afloat awaiting its turn at dock. For the present the docks are being operated upon last year's schedule. President Keefe will meet with the dock managers on Friday to make a new agreement for the season of 1906. No difficulty will be experienced in reaching a satisfactory conclusion, as the question of recognition of the mates' union by the Lake Carriers' Association has been altogether eliminated. This question never should have been projected into the controversy because the dock managers have nothing to do with labor aboard ship, and it was unreasonable to expect that they would permit themselves to be used as a club to whip the lake carriers into line. The calling off of the strike is the result of almost continued secret conferences which have been going on since Monday. President Keefe came over from Detroit on Sunday night and met the longshoremen on Monday morning. It is understood that some of the locals did not take kindly to the fight that was being waged at their expense to force the recognition of the mates' union, especially so, as it was apparent that the mates were generally standing by their boats and that the contention of the vessel owners that no mates' union existed among the men that were actually employed aboard ship was evidently true. President Keefe therefore abandoned the contention for the mates' union, and so notified the dock managers.

It is now expected that a working agreement will be entered into before the present week is out. There is really not very much at issue between the longshoremen and the dock managers. The longshoremen worked eleven hours a day up to September 1 last year, and ten hours a day thereafter. Their main demand now is for a ten-hour day throughout the entire season. The dock managers have been rather reluctant to grant this, prompted not so much by the opposition to a working day of that length, but rather through the actual exigencies of trade, which is increasing so fast that every minute's time in handling it is valuable.

When the strike was declared the marine firemen, who are controlled by the longshoremen's association, went out and this put the vessel owners to the test of operating their boats without union firemen. They found little difficulty in doing so. The makeshifts to supply the firemen's places of course were many, but the fact remains that they were filled and the boats were operated. The knowledge of this has been quite a comfort to some of the vessel owners. The strike which has lasted ten days, however, has been an expensive thing all around, vesselmen in general keeping their entire crews aboard ship under full pay, though they were of course earning nothing. It has also been expensive for the longshoremen who, of all classes, are the least able to bear it.

ORE SHIPMENTS DURING APRIL.

The ore movement for April was 253,213 tons greater than that of the corresponding month last year. During April 1,447,386 tons were shipped as against 1,195,173 tons during April of 1905, or an increase of 21 per cent. While the season of navigation opened somewhat later this year than last in point of sailing, it actually opened earlier in that the early vessels last year were seriously delayed in the ice. The greater part of the April movement that was actually at Lake Erie docks during April went directly into cars, but that which arrived after May 1 is still being held by the vessels owing to the longshoremen's strike.

Statistics have not yet been compiled as to the amount of ore on dock May 1, some docks not having reported so far, but the amount will be found to be small, showing that the forward movement from dock to furnace during the winter and spring has been very active. Lake Erie docks are in better shape this year than they have ever been before. Following were the April shipments by ports:

	April, 1905.	April, 1906.
Escanaba	253,299	243,254
Marquette	104,279	85,216
Ashland	61,697	134,302
Superior	190,703	210,263
Duluth	263,842	383,643
Two Harbors	321,353	390,708
Total	1,195,173	1,447,386
1906 Increase		252,213

COMMERCE OF SAULT STE. MARIE CANAL.

The monthly report of Mr. Joseph Ripley, superintendent of the Sault Ste. Marie canal, shows that the total commerce of the canal for April was 2,513,267 tons as against 1,300,166 tons for April, last year. The detailed report is as follows:

EAST BOUND.

Articles	U. S. Canal	Canadian Canal	Total
Copper, net tons	7,491	.....	7,491
Grain, bushels	6,835,237	181,000	7,016,237
Building stone, net tons	.....	.....	.....
Flour, barrels	325,260	7,460	332 720
Iron ore, net tons	1,222,885	87,172	1,260,057
Iron, pig, net tons	.....	.....	.....
Lumber, M. ft. B. M.	23,753	1,395	25,148
Silver ore, net tons	.....	.....	.....
Wheat, bushels	6,353,471	2,148,027	8,501.498
Gen'l. Mdse., net tons	1,204	8,127	9,331
Passengers, number	104	64	168

WEST BOUND.

Coal, anthracite, net tons	61 869	12,965	74,834
Coal, bituminous, net tons	524,618	63,162	587,780
Flour, barrels	.....	.....	.....
Grain, bushels	.....	.....	.....
Manufactured iron, net tons	18,805	5,630	24,435
Salt, barrels	42,482	2,063	44,545
Gen'l. Mdse., net tons	38,675	15,540	54,215
Passengers, number	200	341	541
Freight, East Bound, net tons	1,649 215	116,117	1,765,332
Freight, West Bound, net tons	650,338	97.597	747.935
Total Freight, net tons	2 299,553	213.714	2,513 267
Vessel Passages, number	825	254	1,079
Reg'd Tonnage, net tons	1,766,491	240, 49	2,006,640

IMPROVING THE CANADIAN CANAL.

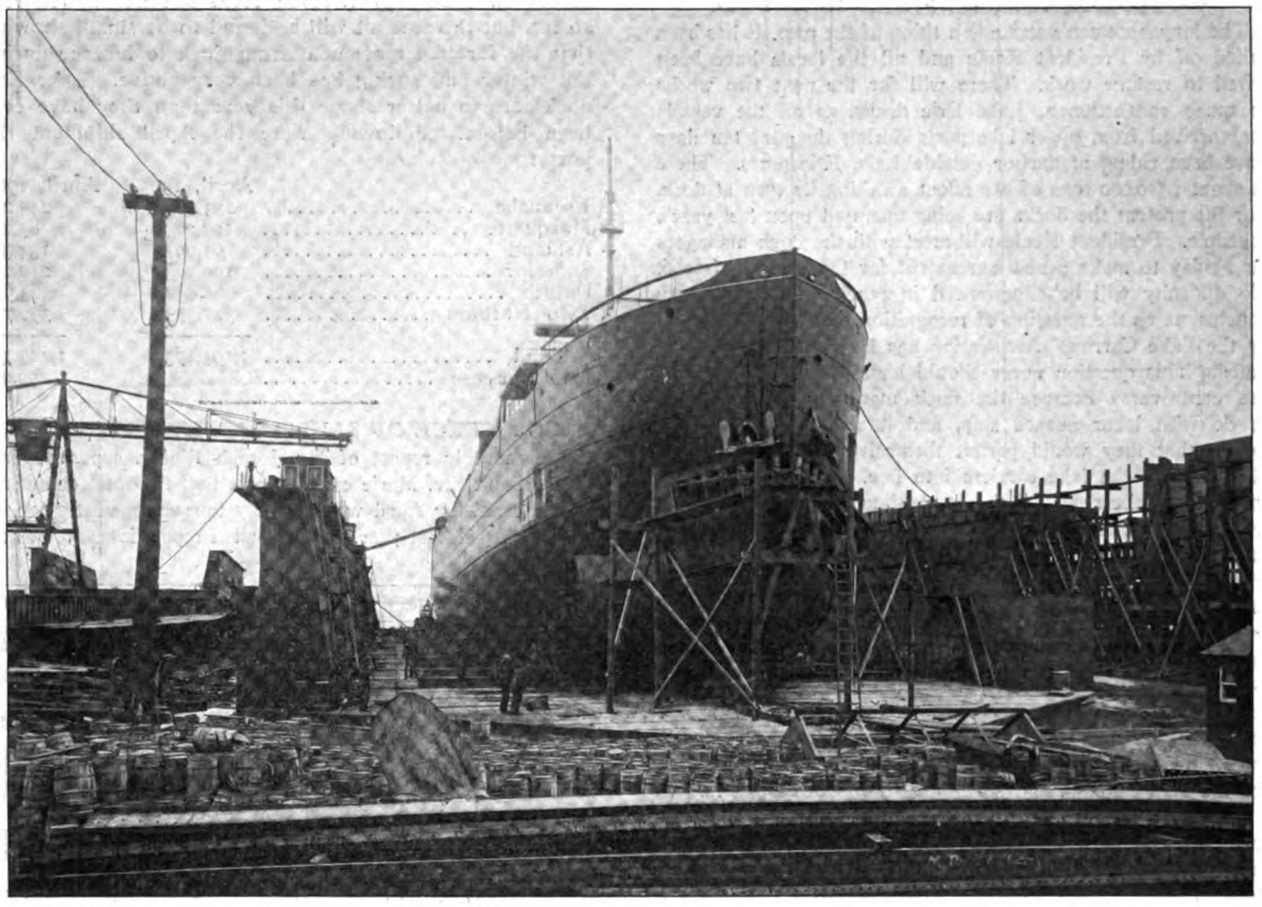
The Dominion government is deepening the upper entrance to the Canadian canal at Sault Ste. Marie. It is now 18 ft. at low water, but will be made the same as the lower entrance, 21 ft. 5 in. Contract has been entered into with Mr. C. I. Boone to continue the deepening and also the widening of the upper entrance. Contracts have also been let for the extension of the south lower entrance and the south upper entrance pier 800 ft. The government has purchased a considerable area of land alongside the present canal with a view of constructing a wider lock whenever it is necessary to do so. There is no definite program as yet for widening the lock. As there are already vessels on the great lakes that cannot pass through the present Canadian lock, which is only 60 ft. wide, it is quite likely that within two or three years a definite plan will be formulated for another lock.

Capt. James Jackson has been appointed master of the steamer Sylvania in place of Capt. J. W. Ehrhart, who was suspended for sixty days by the local inspector at Marquette.

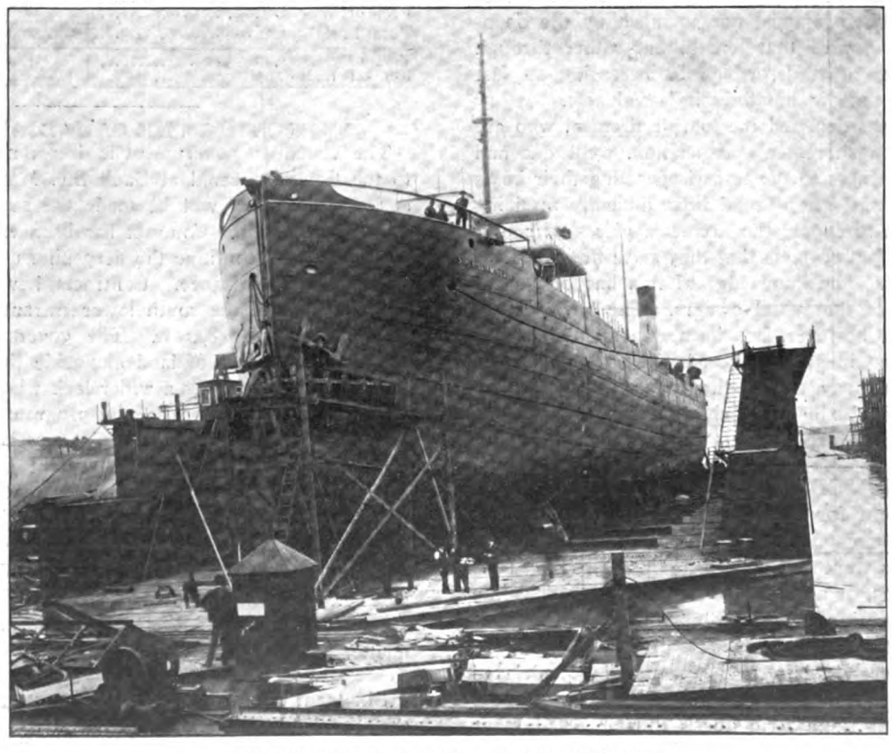
Six train crews and fifty dock men have been laid off on the Northwestern road, and four train crews on the Wisconsin Central, on account of the strike on the lakes.

SIR WILLIAM SIEMENS IN DRY DOCK.

The steamer Sir William Siemens was docked recently at the Ecorse floating dry dock of the Great Lakes Engineering Works. While there have been about thirty dockings altogether in the new floating dry dock, the Siemens was the first large steamer to be docked in it. The event therefore created considerable interest in marine circles. The photographs accompanying this article are illuminating in the extreme and well reveal the capacity of the great structure. The actual time required to raise the Siemens after she was placed over the blocks was one hour and forty-five minutes. At the expiration of this time the dock was dry and in another fifteen minutes the damage had been located and men were at work cutting out rivets preparatory to removing the damaged plates, of which there were thirty, in addition to the broken wheel and bent rudder and frame. The Siemens was damaged in trying to pull the steamer Wm. E. Corey off the rocks at Gull Island last November. During the great storm which marked the closing of last season's navigation, the Corey struck the Gull Island reef while the water was at its highest stage, so that when it receded she was imprisoned fast. After resisting efforts to budge her for several days, she suddenly floated off, the Siemens being damaged in the



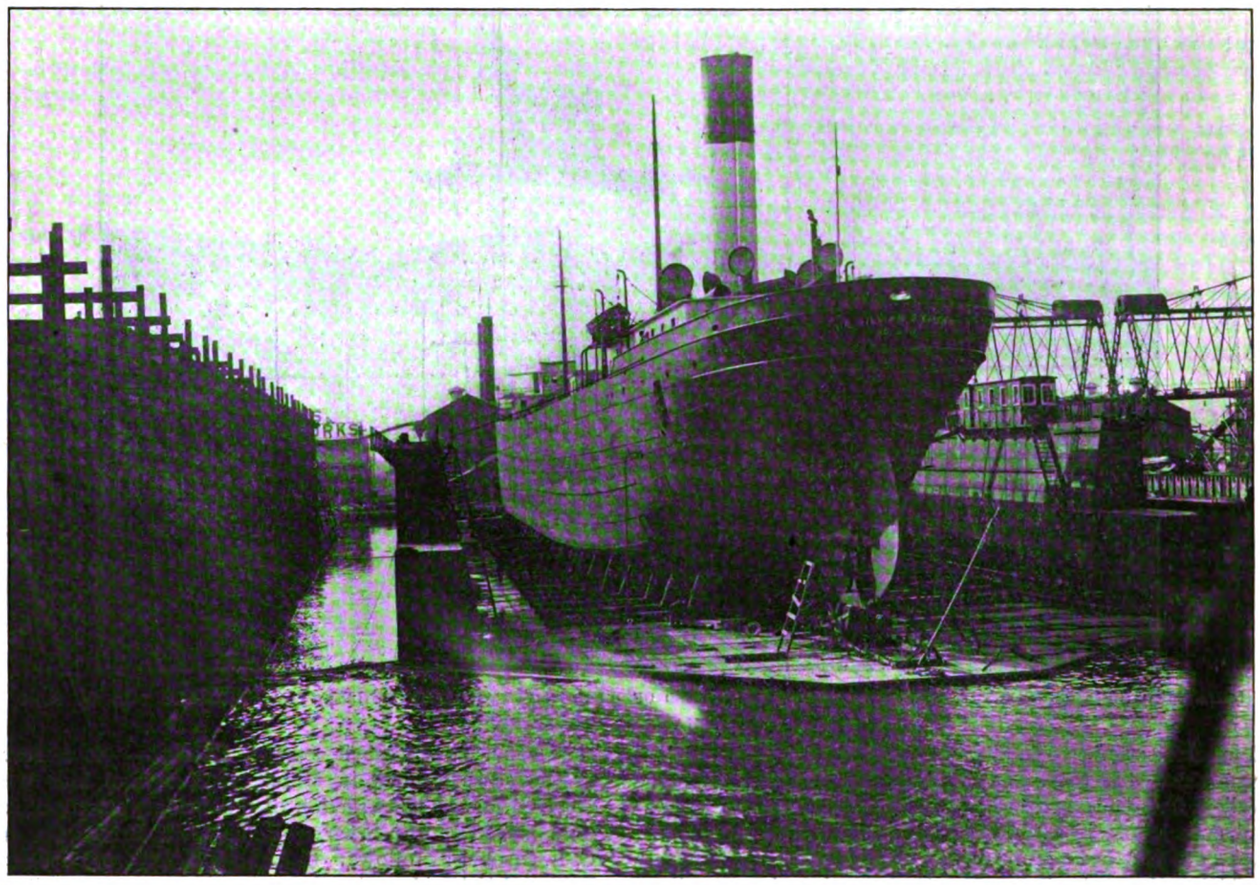
THE STEAMER SIR WILLIAM SIEMENS IN THE STEEL FLOATING DRY DOCK AT THE ECORSE YARD OF THE GREAT LAKES ENGINEERING WORKS, DETROIT.



SHOWING DAMAGES TO THE SIEMENS' BOW.

work of rescue by colliding with other vessels.

The floating dry dock of the Great Lakes Engineering Works has capacity for ships 600 ft. long and can handle

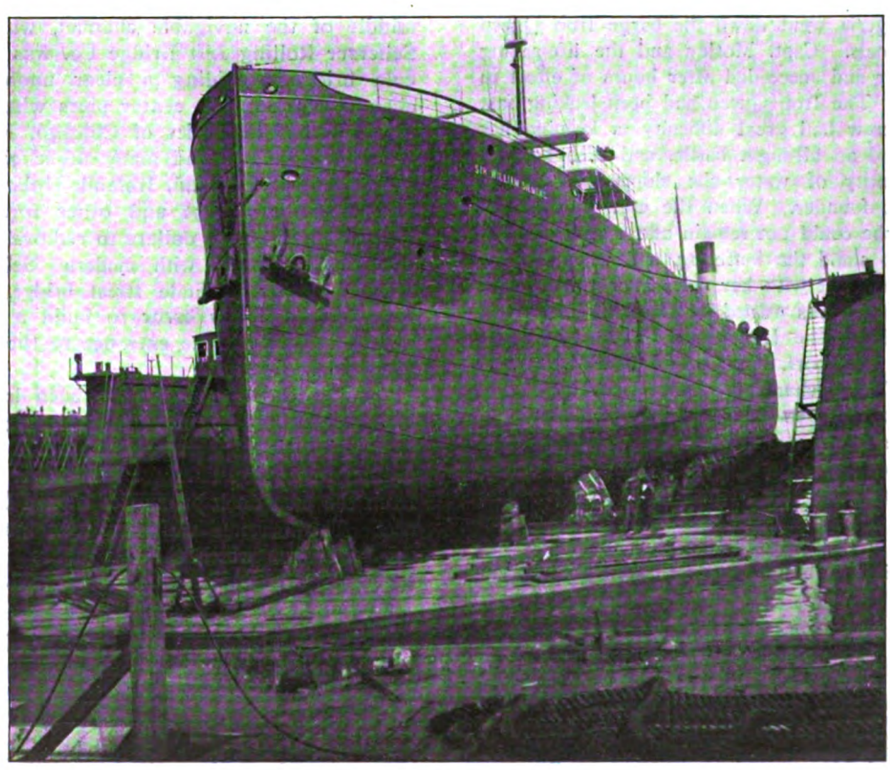


STERN VIEW OF THE STEAMER SIR WILLIAM SIEMENS IN THE FLOATING DRY DOCK.

anything on the lakes. The floor of the floating dock is practically even with the level of the shops and yard floors and the location of the dock is so close to the shops that labor and material may be handled with the utmost expedition.

GREAT STORM

The opening of navigation has been marked with a storm of considerable violence, probably the most violent May storm of several years. The storm reached its highest point early Wednesday morning and claimed two victims just outside of the Cleveland breakwater. Owing to the longshoremen's strike a considerable fleet was anchored outside of the port of Cleveland, including the wooden tow barge Algeria and the big barge Iron Queen. Owing to the strike the Algeria could not get a tug and was compelled to ride out the storm. Early Wednesday morning it was seen that the Algeria was in bad shape, and the big steamer L. C. Hanna steered for her and began circling about her, lessening the radius with each revolution. It was difficult work to keep clear of the barge and at the same time come near enough to be of practical service in rescuing the crew. The Hanna finally sent out a raft attached to a life line, and succeed-



BOW VIEW OF THE SIEMENS IN DOCK.

LAUNCHING OF THE HENRY B. SMITH AT THE LORAIN YARD OF THE AMERICAN SHIP BUILDING CO., BUILDING FOR W. A. & H. A. HAWGOOD, CLEVELAND.

ed in taking off the cook, Thomas Sullivan, of Buffalo. Sullivan stated that Capt. Martin Elnen and Engineer George Wallon had both perished. The remainder of the crew had gone ashore in a rowboat the evening before the storm broke out and had not returned. Shortly after the Hanna had taken the cook off the Algeria she sank and apparently broke in the middle. Nothing is now visible of her except her spars.

Soon after the Algeria went down the barge Iron Queen put out distress signals. Capt. Motley and the life-saving crew went out to her and succeeded after hours of effort in taking off the crew. The Iron Queen had been leaking fast for hours and the crew had great difficulty in keeping her afloat. The crew had an all-night battle, and with her ore cargo and the quantity of water she shipped, it was a wonder she did not founder. When the crew left her it was the belief that she could not remain afloat much longer, but she continued to stand the buffeting, and when the sea quieted was still afloat, but with her sides almost level with the water. The Algeria was owned by Capt. Sydney Scott of Mt. Clemens, Mich. The Iron Queen is owned by the Duluth & Atlantic Transportation Co. of Detroit, and is managed by Capt. W. C. Richardson of Cleveland.

During this storm the steamer M. I. Wilker foundered off Colchester. The crew was saved. The steamer John Schroeder was thrown against a pier at the mouth of Grand Haven harbor, suffering the loss of part of her cargo. The tow barge Armenia, ore laden and bound for Cleveland, was sunk off the mouth of the Detroit river, thus making a bad prelude to what is likely to be the greatest commercial season in lake history.

SCHERZER ROLLING LIFT BRIDGES.

The following letter sent to the *Chicago Tribune* by Theodore Kandeler, consulting engineer of the Scherzer Rolling Lift Bridge Co., is self-explanatory:

"Our attention has been called to the following statement published in the *Tribune* today referring to the eight-track railroad bridge across the drainage and ship canal at Campbell avenue, Chicago: As a result of the advertisement in March, 1898, several bids were received for the construction of this bridge, among others were bids from the Scherzer Rolling Lift Bridge Co. and C. L. Strobel as follows: C. L. Strobel, $235,424; Scherzer Rolling Lift Bridge Co., $369,140. Your report fails to mention the essential fact that the bid submitted by C. L. Strobel was for a bridge with five piers built in the middle of the navigable channel, while the bid of the Scherzer Rolling Lift Bridge Co. was for a modern bascule bridge providing a clear unobstructed navigable channel without any center piers whatever. In view of the fact that the cities of Chicago, New York, Boston, Cleveland, Buffalo and many other cities in the United States and in England, Ireland, Holland, Russia, Argentine Republic, Egypt and other foreign countries are spending millions of dollars to remove center pier bridges and replace them with modern Scherzer rolling lift bridges, similar to State street bridge, Chicago, it would have been a costly error to build a center pier bridge and thereby block the entrance to the drainage and ship canal to navigation.

"Had a center pier bridge been built it would have been necessary to remove the same at an enormous cost and replace it with a modern bascule bridge to open the drainage and ship canal for navigation and obtain revenue from the vast dock properties owned by the sanitary district. This revenue will more than pay the interest on the $50,000,000 which the tax payers of Chicago have invested in the sanitary and ship canal."

Mr. S. P. Blackburn, ship chandler, formerly of No. 362 Atlantic avenue, Boston, has moved to much larger and more modern quarters at No. 287 Atlantic avenue.

Mr. George S. Ritchie, lately with the Metropolitan Steamship Co., has been appointed superintending engineer of the New York & Porto Rico Steamship Co.

AROUND THE GREAT LAKES

Capt. T. A. Linquist, a well known lake master, died at Menominee of pneumonia this week.

The steamer David Z. Norton left Cleveland on Monday on her maiden trip to the head of the lakes.

The steamer Midland Queen, which was in collision with the steamer W. G. Mather, has gone to Wyandotte for repairs.

Capt. T. B. O'Connor, grand president of the Licensed Tugmen's Protective Association, is ill at his home at Buffalo with pneumonia.

Capt. Wm. D. Ames has been appointed master of the steamer J. M. Jenks of the Hawgood fleet. Captain Ames is president of the Ship Masters' association, and is one of the most competent masters on the whole chain of lakes.

Following were the bids received by Maj. Charles L. Potter for building a steel tug for service on Lake Superior: Racine Boat Mfg. Co., Muskegon, Mich., $35,950; Great Lakes Engineering Works, Detroit, $59,500; Manitowoc Dry Dock Co., $55,000.

The package freighter building for the Rutland Transit Co. at the Cleveland yard of the American Ship Building Co., will be launched on Saturday next. The bulk freighter E. J. Earling building at the West Superior yard of the American Ship Building Co. for H. H. Oakes of Detroit, will go overboard May 19. The bulk freighter Sir Thomas O'Shaughnessy, building at the Wyandotte yard for Charles O. Jenkins of Cleveland, will be launched on May 26.

It is estimated that repairs to the steamer Zimmerman, sunk in St. Mary's river in collision with the Saxona, will cost about $50,000. Capt. Cyrus H. Sinclair, representative of the underwriters, says that the injuries to the Zimmerman are among the most serious ever sustained by a boat on the lakes. The bow of the Saxona cut through the Zimmerman as far as the windlass, which was knocked out of position. The blow landed just aft of the forward position of the Zimmerman's pilot house. The Donnelly Wrecking Co. will use the cofferdam method in raising the steamer. After she has unloaded her cargo of coal at the Sault she will be taken to Toledo for repairs.

BIDS FOR SEA-GOING SUCTION DREDGE.

Following were the bids submitted to the Isthmian canal commission for two sea-going suction dredges for use on the Panama canal:

	Item 1	Item 2	Items 1 & 2	Delivery.
Union Iron Works Co., San Francisco, Cal.		$500,000		San Francisco
New York Shipbuilding Co. Camden, N. J.	$410.000	$410,000	$780 000	Camden N. J.
Hollando-American Dredge Bldg. Syndicate, Shiedam, Holland			852,000	
Delivery at Cristobal or LaBoca			89,000	
Wm. Simons & Co. Ltd., Renfrew, Scotland	327,000	327,000		Renfrew Scotland
Delivery at Cristobal	17,980			
Delivery at LaBoca		34,020		
Newport News Shipbuilding & D. D. Co., Newport News, Va.	460,000	460,000		Newport News, Va.
Maryland Steel Co., Sparrows Point, Md,	366,900	368,900	724,855	Sparrows Point, Md.
Motley, Green & Co., New York	425.000	465,000		Cristobal & LaBoca
Fore River Shipbuilding Co., Quincy, Mass.	450,000	450,000		Quincy, Mass.
The Moran Company Seattle, Washington		435,000		Seattle

The Anglo-American Oil Co. has given contract to Harlan & Wolff, Belfast, Ireland, for a bulk oil steamer 491 ft. long.

ITEMS OF GENERAL INTEREST.

The Maryland Steel Co., Sparrow's Point, Md., recently launched a steam lighter 160 ft. long for the Pennsylvania Railroad Co.

The Maryland Steel Co., Sparrow's Point, Md., has contracted with Sanford & Brooks of Baltimore, to extend their ore pier 200 ft.

The revenue cutter Androscoggin building at the yard of the Pusey & Jones Co., Wilmington, Del., for service off the Maine coast, will be launched in the near future.

The boilers for the four freight steamers building at the yard of the Fore River Ship Building Co., Quincy, Mass., will be supplied by the Lake Erie Boiler Works of Buffalo.

Mr. H. L. Des Anges, superintendent of floating equipment for the Long Island railroad, has been appointed superintendent of the Montawk Steamboat Co., vice Capt. Van Cleaf resigned.

The three-masted schooner building by the New England Ship Building Co., Bath, Me., for J. B. Dickie & Son, has been named Isabel B. Wiley, in honor of the wife of Capt. L. S. Wiley, who will command her.

A revision in colors of coast chart No. 4, Lake Michigan, showing the coast from Chicago to the Wisconsin state line has just been issued by the United States Lake Survey and is for sale by the MARINE REVIEW.

The Fore River Ship Building Co., Quincy, Mass., has put out in pamphlet form the test of the Curtis marine turbine made by the naval board and described in the *Journal of the American Society of Naval Engineers* by Ensign W. G. Diman.

In the MARINE REVIEW of May 3 was published an illustrated article descriptive of the auxiliary schooner Marie Gilbert. As an evidence that the Gilbert Transportation Co., her owners, intend that her equipment shall be first class we learn that she is to have a Shipmate range in her galley.

The Stanley-G. I. Electric Mfg. Co., Pittsfield, Mass., has just put out a little bulletin descriptive of Paragon motors. This apparatus is made in two classes, slow and moderate speed. Both classes are of a uniform standard of excellence, have the same efficiency and a temporary rise not exceeding 35 degrees C.

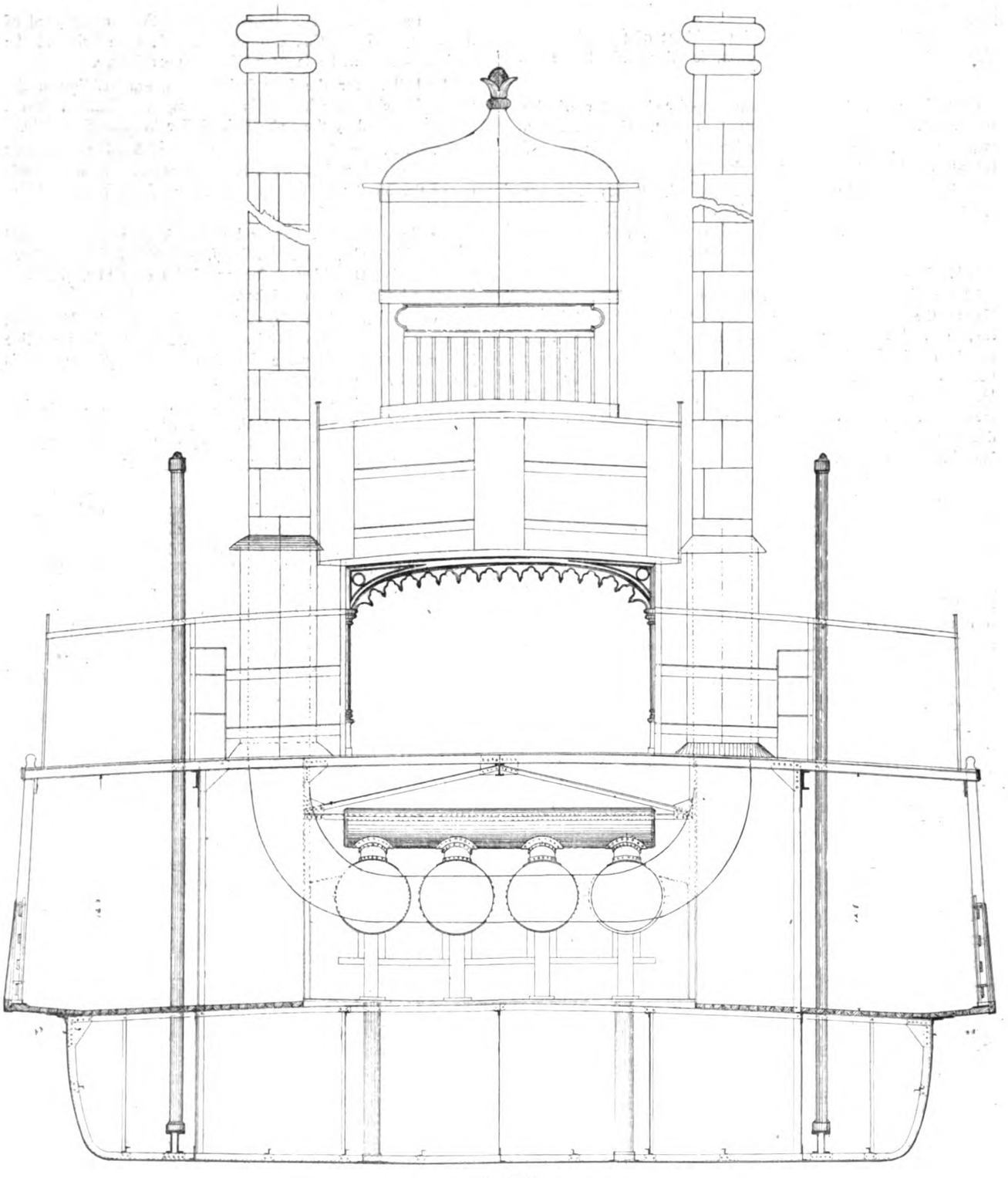
Messrs. Berger-Carter Co., Pacific coast agents of the Falls Hollow Staybolt Co., who were victims of the San Francisco fire, have opened temporary quarters at Third and Washington streets, Oakland. They report that they are well and will resume business on a larger scale than ever with new stock in their new quarters. They were formerly located at 34-40 Beale St., San Francisco. They deserve a great deal of credit for the promptitude with which they have resumed their business.

The Newton Machine Tool Works, Twenty-third, Twenty-fourth, Vine and Wood streets, Philadelphia, has issued catalog No. 43, descriptive of Newton cold saw cutting-off machines. The machines described in the catalog are adapted to the cutting of round and square stock, I-beams, channel bars, also armor plate, nickel, steel and gates or risers on steel castings. The spindles on the different designs are driven either direct or through gearing by phosphor bronze worm-wheels and hardened steel worms of steep lead. All the machines have automatic feeds, and with the exception of the two small sizes of bar saws, have quick return to carriage. The machines are very heavy and rigid, are powerfully driven and are adapted to the heaviest work within the capacity of the tools. The catalog will be sent to anyone interested.

RIVER STEAMER SAMUEL S. BROWN.

The new stern wheel river steamer Samuel S. Brown, now building at Pittsburg for the Arkansas River Packet Co., is going to be the finest and most complete steamer on the western rivers. The new boat is now well under way, the contract for its construction being let by the packet company to the James Rees & Sons Co., of Pittsburg, who sublet the contract for hull construction to the American Bridge Co., which is well along with the work at its Ambridge plant, 16 miles below Pittsburg on the Ohio river.

The Samuel S. Brown will be 230 ft. length of hull from stem to after transom and 255 ft. long over all, including wheel. The molded breadth will be 44 ft., with 3 ft. 6 in. guards on each side, or 51 ft. over all. The molded depth is 6 ft. 3 in. at the shallowest part and the sheer forward is 5 ft. 6 in. and 2 ft. at the after part of the hull with a 10-in. crown of deck. The hull will have three fore and aft and five cross bulkheads, thus giving a total of 21 watertight compartments.



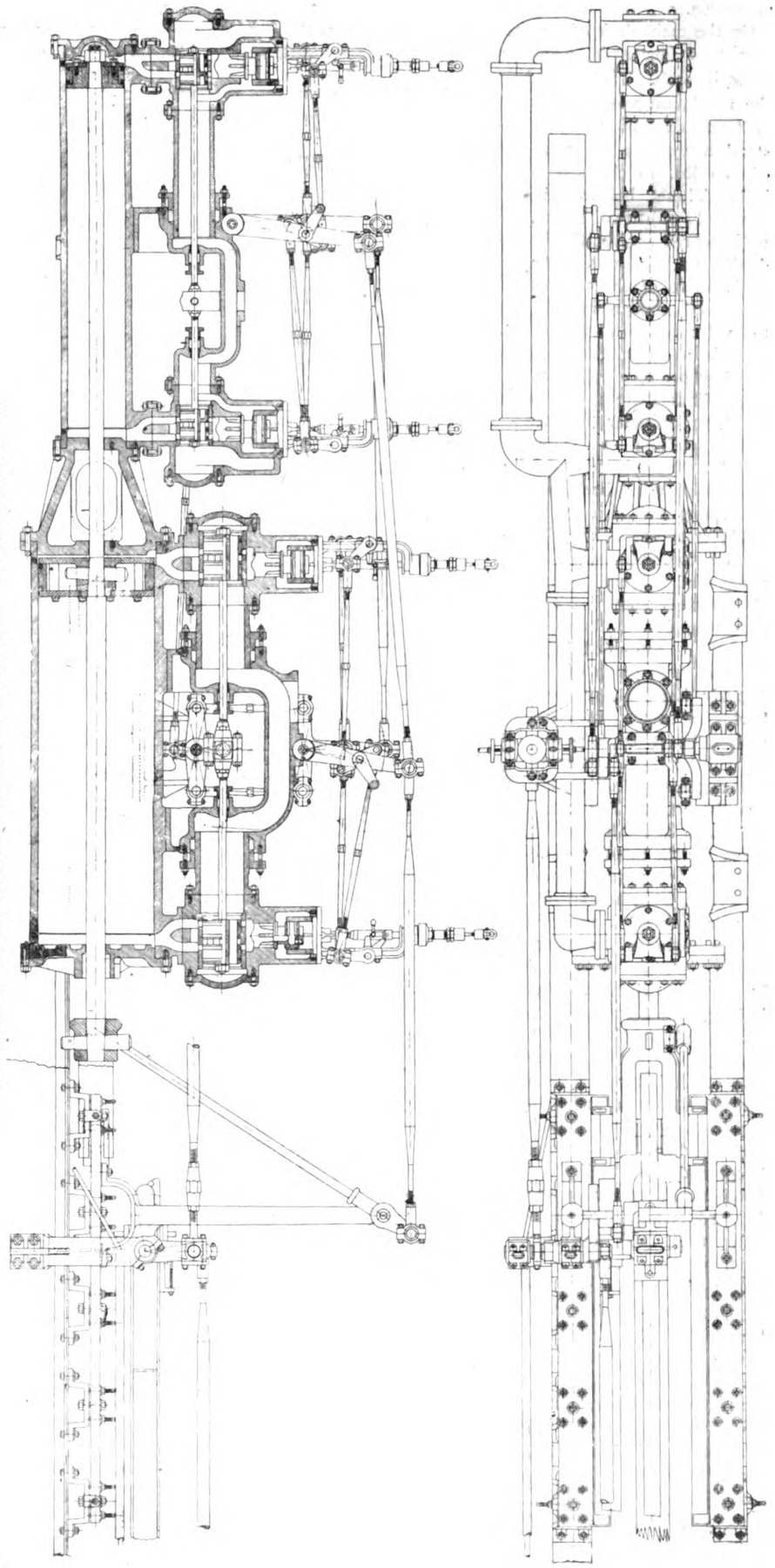
CROSS SECTION FORWARD END OF BOILERS. STEAMER S. S. BROWN.

The frames, which are of 3½ by 4 by ⅜ material are

spaced 18 in. amidship and 15 in. from the forward end of the boilers to the stem. The deck beams, 3 by 4 by 3/8 in. are carried on alternate frames. The plating, and in fact all the steel used in the boat is mild open-hearth throughout, and rivets are of the same material. The plating is 3/8 and 5-16-in. thickness with 60,000 pounds tensile strength and is double riveted and punched according to the latest rules of the American Shipmasters' association. There are eight Z-bar keelsons on the bottom of the hull extending from stem to stern between the bulkheads and one Z-bar keelson on each side connected to the side frames by angle-iron clips.

At the bottom on each side between the first bulkhead and the side of the boat there is a heavy keelson running from the forward end of the cylinder timbers to the forward end of the boilers, a beam which acts as a footlings for the main hog-chain braces to heel on. The keelsons are made of two 12-in. by 15-lb. channels with a cap on top 10 in. wide by 15 lbs. per square foot.

The stem is of hammered steel 2¼ by 10 in., slotted out to receive the keel plate. The boat also has three breast hooks forward, running back to the forward bulkhead, and the two transoms aft have secured upon them four balance rudders of steel operated by the Johnson steam steering apparatus. The deck of the boat in the engine room and under the boilers and the coal bunkers are of 3-16-in. steel, while the remainder of the deck is composed of 2¾ by 6-in. selected white pine amply caulked with cotton and oakum. The bits, kavels and chalk are of iron. The engine beams are of steel and are secured to the deck beams and plating of the hull with a heavy knee and a new design of A-frame bracing, doing away with the old style wheel chain bracing. This boat has one set of main hog-chains on each side, braces of which are made of heavy 10-in. tubing with cast iron caps and shoes. One of the hardest propositions facing steamboat men in shallow waters is the tendency of the boats to hog in the middle, but the longitudinal strength of the S. S. Brown is insured by the system of hog chains which are of ample strength to withstand this tendency of long, shallow river boats. In addition to this



PLAN AND SECTION OF ONE OF THE TWO COMPOUND ENGINES OF THE S. S. BROWN.

the arrangement of the longitudinal bulkheads is additional protection.

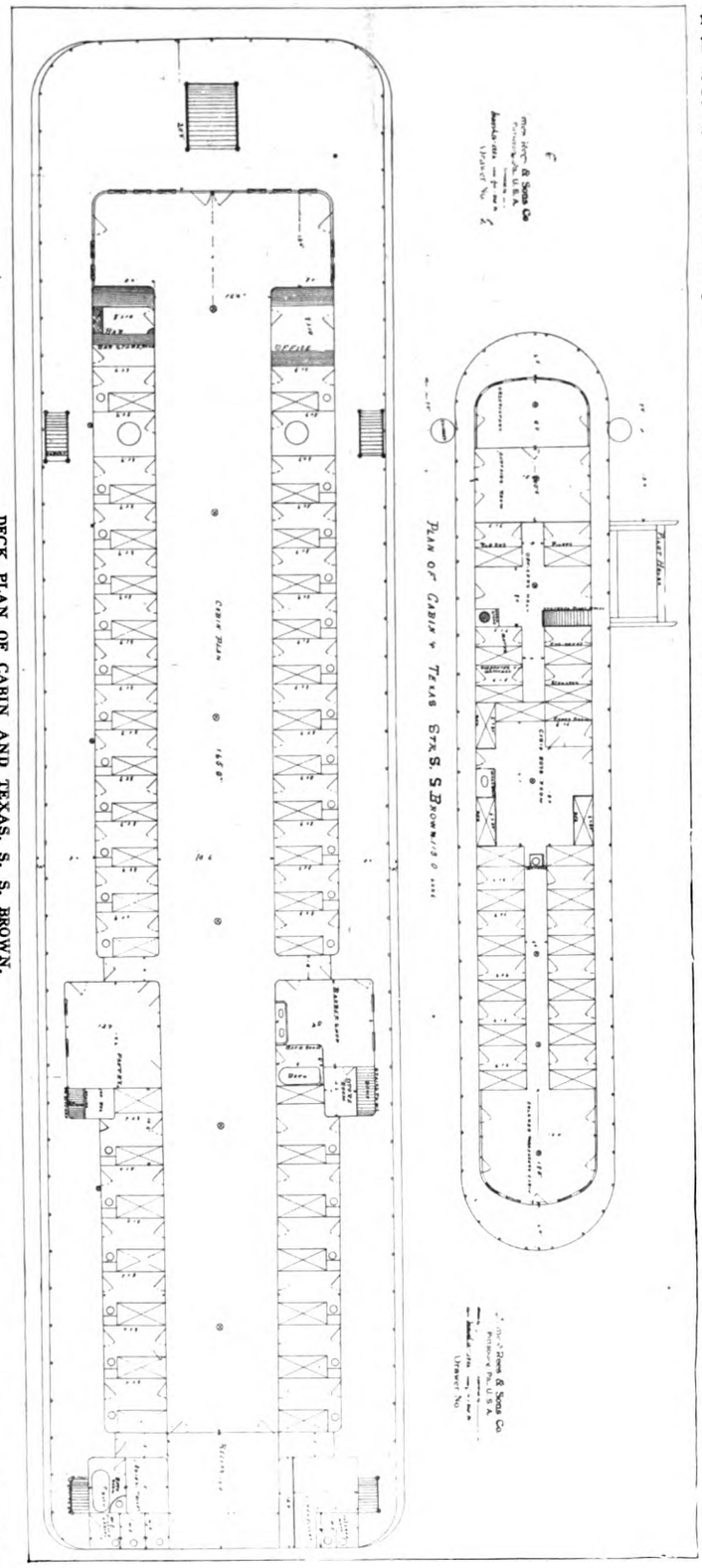
On the main deck of the steamer S. S. Brown, the boilers consist of four 44-in. diameter boilers, 24 ft. long with six flues in each. They are of the regulation western river type and built to withstand a working pressure of 180 lbs. to the square inch. These boilers are equipped with two stacks, well secured against fire by double stack casings. The engines are of the tandem compound condensing piston valve type with Poppet cut-offs on both the high and low pressure cylinders. The cylinders are 15½ and 32 in. in diameter by 8-ft. stroke working a water wheel 24-ft. diameter. The buckets of the wheel are 32 ft. long and 26 in. wide.

The boat has a Wheeler surface condenser with air pump and direct acting circulating pump. The water supply for the boilers will be provided by a "doctor" feed pump of the familiar western river type having a heater of iron with a heavy brass worm. It will heat the water to 190 degrees before it enters the boilers. The equipment also includes a steam pump for the auxiliary supply and fire purposes and a "Triumph" generator for electric lighting, with a double engine of the Sturtevant pattern which will be operated when the boat is lying idle by an upright submerged tubular boiler. The lighting will be by the best incandescent system throughout cabin and hull and having on the sides at the landings three arc lamps and a search-light of 6,000 candle power at the forward end of the hurricane roof and operated from the pilot house.

One of the most interesting features of the new boat will be a heavy stage which will be 65 ft. long by 6 ft. wide, which will be equipped with an electric traveling conveyor for the purpose of handling freight to and from the boat. The mast and booms will be of steel and the arrangement may be seen in the accompanying longitudinal profile view of the steamer.

The forward capstan will be of cast iron, of very heavy pattern and connected to a double 6-in. by 8-in. reversing engine. This capstan will also be used for handling the stage.

The passenger accommodations on the steamer S. S. Brown will be very elaborate and on the second, or boiler deck, will consist of 50 staterooms. On this floor will also be the pantry, barber shop and bath rooms. The main cabin will also be used as a dining room. This cabin will be supported by T-iron stanchions, secured to the floor frames and deck beams of the hull and will have channel beam stringers secured to the stanchions by gusset plates and at each stanchion will be riveted a 6-in. channel iron carlin thus making the cabin frame almost entirely of steel frame construction.



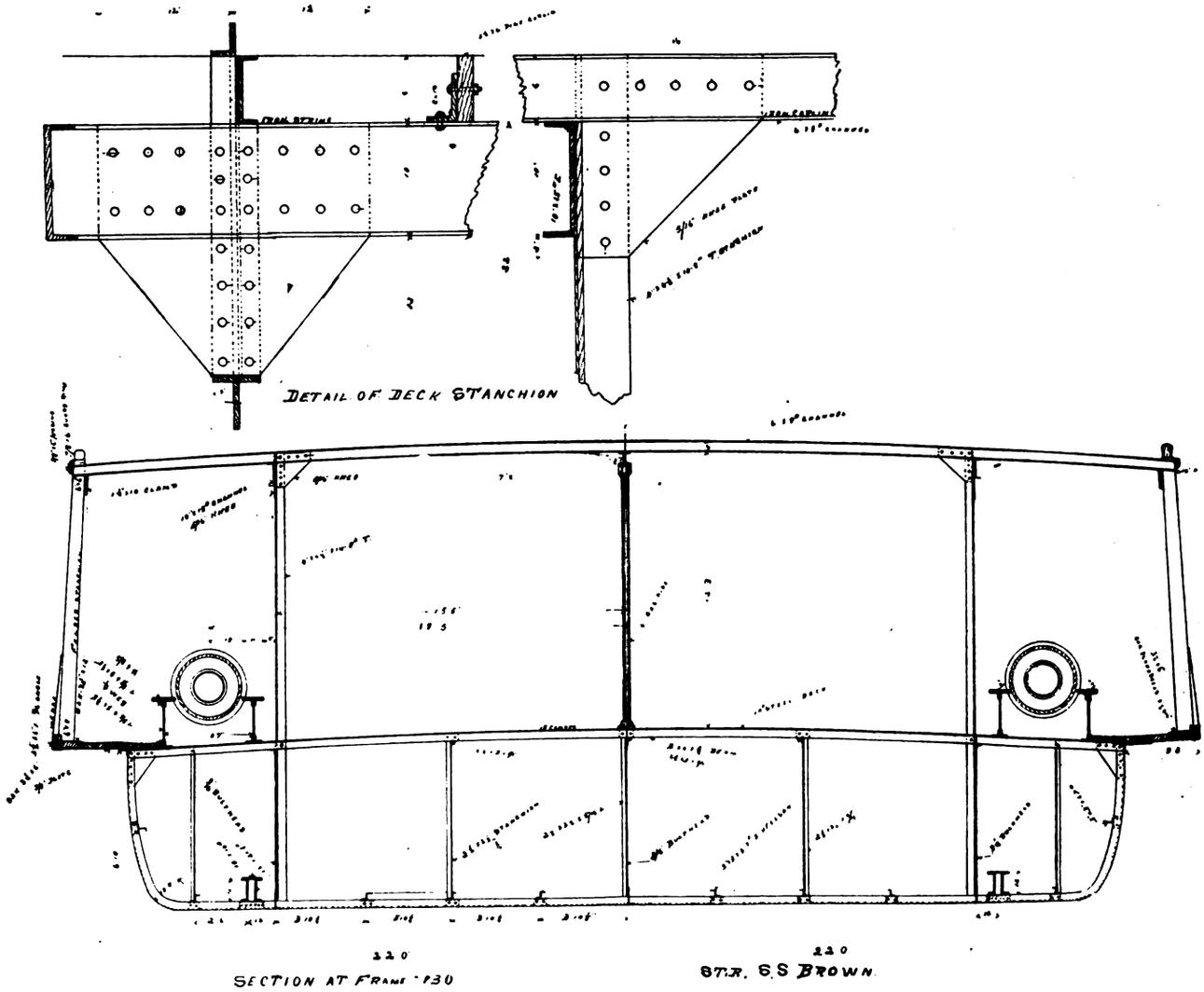
DECK PLAN OF CABIN AND TEXAS, S. S. BROWN.

On the upper or hurricane deck will be located the Texas and in the after part of this, there will be what on river steamboats is known as "Freedmen's Bureau," this, on the steamer Brown being composed of 30 staterooms with separate dining room and accommodations for colored passengers.

On the forward part of the Texas will be the observation room, the captain's quarters and quarters for the officers and cabin crew. The pilot house, 12 by 16 ft., will be on the top of the Texas over the officers' quarters. The deck crew and firemen and "deckers," or deck passengers not taking staterooms will be quartered on the main deck aft, next to the stern bulkhead, the room being constructed of light galvanized iron. The crew of the boat will consist of 80 men.

The hull was modeled by Marine Architect Thos. Dunbar, the cabin designed by P. J. Ingoldsby, and the hull built under the supervision of Marine Constructor Donovan, of the American Bridge Co.

The Neafie & Levy Ship & Engine Building Co., Philadelphia, has received contract from Capt. O. A. Thompson, Baltimore, for a steel tug 120 ft. long, 24-ft. beam and 13 ft. three in. deep, to be ready in September. The new tug will be named Albany.



CROSS SECTION AT FRAME 130. STEAMER S. S. BROWN.

MERCHANT MARINE LEAGUE

The Builders' Exchange, of Cleveland, held their regular quarterly meeting at their commodious rooms in the Chamber of Commerce building, on the evening of May 7, there being a large attendance, including many of the best known builders in the city, all of whom are large employers of labor.

After the regular business of the Exchange had been disposed of, and which included a discussion of a report to increase the amount of the fees to be paid by prospective owners of new buildings to the building department of the city, ending with the reference of the matter to the board of directors with power to act, the special business of the evening was reached.

INDORSEMENT OF PENDING SHIPPING BILL ASKED FOR.

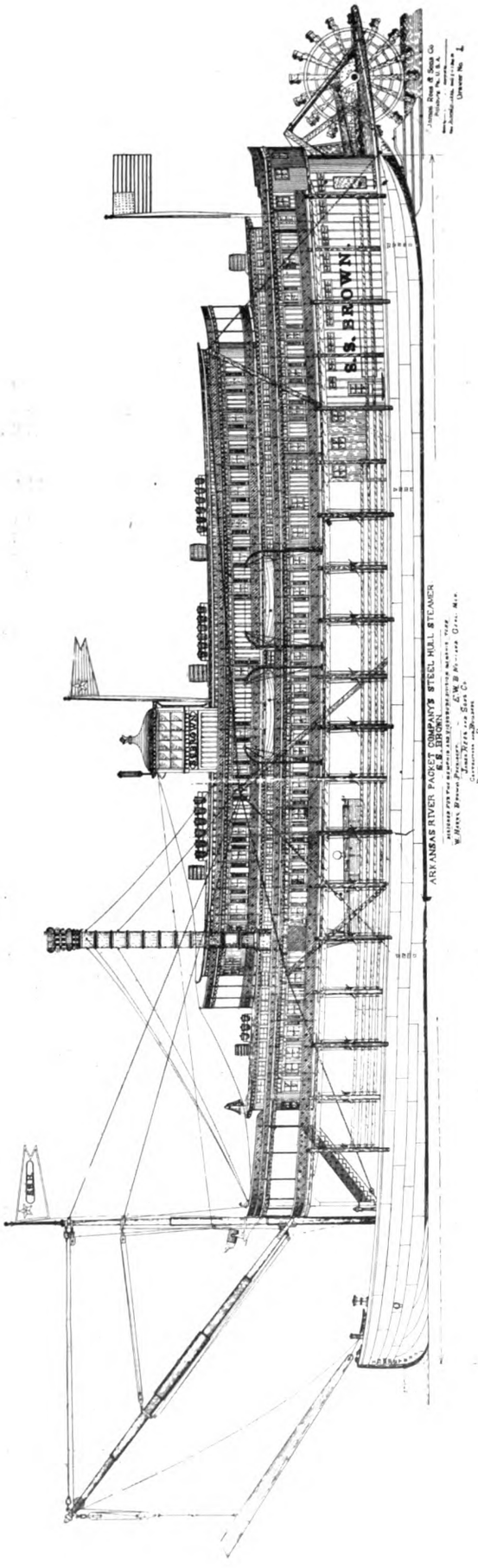
A communication from Secretary John A. Penton, of the Merchant Marine League of the United States, addressed to the secretary of the Builders' Exchange was then read, in which attention was called to the fact that in all parts of the United States, commercial and business organizations are adopting resolutions favoring the passage of legislation that will build up our shipping in the foreign trade, and suggesting that the matter be taken up by the Builders' Exchange. This communication was referred by the board of directors to the legislative committee, the latter reporting that the subject matter was somewhat out of the usual order, and recommending that it be placed before the full association at its meeting.

RESOLUTION PREPARED BY BUILDERS' EXCHANGE.

The chairman of the legislative committee of the Builders' Exchange, Mr. C. B. Palmer, then presented the following resolution as having been framed, with a view to its adoption by the exchange, should the latter take action in favor of the pending shipping bill:

Whereas, With the phenomenal growth of our great national industries, for forty-five years there has been a steady decline in our shipping in the foreign trade, the subject having been thoroughly investigated during the past two years by a commission appointed by congress for that purpose, pursuant to the president's suggestion, the commission rendering a report, accompanied by a bill to carry into effect the recommendations contained in said report, the enactment of which bill, which passed the United States senate on February 14, 1906, we believe will cause a great and permanent upbuilding of our deep sea shipping; therefore be it

Resolved, That the Builders' Exchange, of Cleveland, Ohio, solicitous for the upbuilding of our foreign-going shipping, for its expansion and prosperity, and believing that a marine of our own will relieve us of an unstable dependence upon foreign shipping for the marketing of our exports, will keep in our own channels of trade many millions an-



LONGITUDINAL PROFILE STEAMER S. S. BROWN.

nually now paid to foreigners for doing our foreign carrying, and will prove a necessary and invaluable resource for the army and the navy in time of war, heartily approves of the Merchant Marine Commission shipping bill and strongly urges its adoption by the house of representatives; and be it further

Resolved, That a copy of this resolution be sent to each senator and representative in congress from the state of Ohio.

ADDRESS BY H. D. GOULDER, PRESIDENT MERCHANT MARINE LEAGUE.

Before action was taken on the resolution President McAllister called upon President Harvey D. Goulder, of the Merchant Marine League, who had been invited to be present, to address the exchange on the subject of our merchant marine. Mr. Goulder responded, briefly sketching the circumstances that led to the formation of his League, through the presence in this city two years ago of the Merchant Marine Commission, consisting of five senators and five representatives, the facts that were at their hearings elicited as to the decline in our foreign shipping, the handicaps upon American exporters in reaching and retaining foreign markets, especially in this hemisphere, and the patriotic, public-spirited and unselfish impulse that led about twenty-five gentlemen, mostly members of the Chamber of Commerce, to organize a league that should educate public sentiment to the needs and benefits of an American merchant marine. Mr. Goulder then tersely and most interestingly described the conditions affecting the growth of our foreign-going marine, the enormous subsidies paid annually by foreign governments to their shipping, aggregating $28,500,000, our government on the other hand saving $2,500,000 a year on the transportation of its ocean mails. Then he instanced the benefits conferred by the payment of subsidies, in the reinforcement of national defenses, in increasing foreign markets for our exports, in reducing the cost of ocean transportation, and in other ways. He stated that it was untrue that Japan had yet acquired the finest and best ships ever built in the United States, now on the Pacific, as had been widely stated, although confessing that the Japs held an option on many of the best of those ships. He dilated at some length upon the remarkable change in public sentiment that has occurred of late toward the shipping bill, showing how newspapers, famous for their hostility to previous shipping bills, were either neutral or had become friendly toward the Merchant Marine Commission's bill, and predicting its passage through the house of representatives, as it had passed the senate.

ELOQUENT TALK BY PRESIDENT PRENTISS, OF THE CHAMBER OF COMMERCE.

President McAllister then called upon President F. F. Prentiss, of the Cleveland Chamber of Commerce, who responded in a most forceful and eloquent talk in which he depicted the growth of the great cities of South America, particularly, Palos and Rio de Janeiro in Brazil, Montevideo and Buenos Aires on the Rio de la Plata, how they had splendid pavements, the finest kinds of modern buildings, art museums and every accessory of civilization and refinement that we ourselves possessed, a progressive and expanding population, with immense possibilities in the way of future development, in which, he was sorry to say, for the lack of direct communication, the United States took no part at all. He and his wife had been compelled to first go to London in order to get a steamship that they could take to Brazil, having to twice cross the Atlantic to reach a neighboring republic upon our own hemisphere and much nearer to ourselves than to Europe. In those countries, as in those that he later visited on the west coast of South America, everywhere Mr. Prentiss found consignments from England, Germany and France, of every kind of product that

we ourselves produced in equal abundance, and for which we could find a ready and permanent market, did we but possess the proper steamships, of adequate size and speed, making frequent and regular sailings to those countries containing a population of 40,000,000 people. Mr. Prentiss spoke most earnestly in behalf of the pending shipping bill, commending it to the builders' exchange as a measure well worthy of their indorsement.

SECRETARY PENTON, OF THE MERCHANT MARINE LEAGUE, ALSO SPEAKS.

Then Mr. John A. Penton, publisher of a number of well known periodicals and the secretary to the Merchant Marine League of the United States, was called upon, and made a brief but pointed talk in behalf of an American merchant marine. The league, he said, was not so much interested in specific bills as it was in such legislation as congress should initiate and adopt, as would give us, and quickly, a merchant marine on the seas worthy of our rank as a world power. Mr. Penton referred to the great organizations, like the National Association of Bankers, the National Association of Manufacturers, the National Board of Trade, the Trans-Mississippi Congress, the Wholesale Druggists of America, the National Founders' Association, the National Metal Trades Council, also other national organizations, state legislatures, and public bodies, and innumerable commercial, business and labor organizations in every part of the country, that had adopted resolutions favoring the passage of the Gallinger shipping bill, and winding up with an expression of the opinion that an organization of the prominence and influence of the Cleveland Builders' Exchange would surely feel animated with such public spirit and patriotism as to desire to align itself with the organizations he had named. After Mr. Penton had finished Mr. A. R. Smith, formerly of New York, and now identified with the work of the Merchant Marine League of the United States here in Cleveland, was called upon and made a short address describing the features of the shipping bill in detail, and adding that he hoped that the resolution which had been read would be unanimously adopted.

THE RESOLUTIONS UNANIMOUSLY ADOPTED AMID APPLAUSE.

At the close of the speeches a member moved the adoption of the resolutions, which was seconded, and followd by a discussion of the shipping bill by members of the exchange. Mr. Goulder was asked to explain in what respect the merchant marine commission's bill differed from that advocated by the late Senator Hanna, which he did, pointing out that the Hanna bill made a great feature of high-speed steamships, provision for which was entirely lacking in the pending bill, which provided, rather, for the "delivery wagon type of ship" that carried cargoes and found new markets for our increasing exports of manufactures. Mr. Goulder was asked to state the attitude of Congressman Theodore E. Burton on the bill, to which he replied that he was afraid that, at the present time, Mr. Burton was against it, but, as Mr. Burton was one of his closest friends, a man whom he most highly esteemed and loved, he yet had hopes that he would see the right, and come out for the bill, in which event he would be welcomed by the speaker as was the prodigal son, by the killing of the fatted calf. A most forceful and fetching talk was then made by Capt. F. A. Kendall, a former army officer, now retired, and himself a member of the exchange, who, impressed with the marvelous development of Japan, and its determination to become dominant upon the Pacific, its assured growth as a maritime power, which it would supplement by building the merchant marine for China sure to follow the awakening of that country from its lethargy of centuries, pointed out the duty of our government to prepare for the defense of our Pacific possessions, and our great stretch of Pacific seacoast, than which no way could be so effective as in providing for a great American merchant marine, even should it cost four, or eight, or ten, or even twenty millions of dollars a year. Our neglect to do this, he most earnestly asserted, would eventually involve us in an expense reaching into hundreds of millions of dollars, which it is our duty now, in time of profound peace, he said, to render unnecessary by strengthening ourselves upon the seas with a merchant marine of our own.

President McAllister then asked if there were any others who desired to be heard. There being no response he put the question, the "ayes" ringing out in huge volume and a profound silence following the call for those opposed, the president thereupon declaring the resolutions unanimously adopted, amid a storm of hand clapping.

The evening closed with the serving of refreshments by the exchange, and a pleasant commingling of members and guests. A significant incident pleasingly noted by many, was the presence of a number of youths from our high schools, who intently followed the remarks of each speaker, and who said that the subsidy bill would probably form the subject of spirited debates between the contending teams of the schools.

UNITED BOILER MAKERS AND IRON SHIP BUILDERS.

The United Boiler Makers and Iron Ship Builders of North America also adopted resolutions very similar to those adopted by the Builders' Exchange, thus linking employer and employed in a common cause. The resolutions follow:

Whereas, The revival of American ship building for the foreign trade, provision for which is made in the Merchant Marine Commission shipping bill, which passed the United States senate on February 14, 1906, and is now in the hands of the House, Merchant Marine and Fisheries Committee, would be of immediate and permanent benefit to American labor, especially that employed in ship building, in which industry it has been truthfully said that "all trades are united," and

Whereas, If American ship yards should be employed in replacing with American vessels the five millions of tons of foreign shipping now employed in the foreign trade of the United States, there would be better hours, better pay and continuous employment for all of those engaged in shipbuilding or its allied industries, for a great many years to come, assuring such a permanency in the ship building business in the United States as to eventually give this country front rank in this great industry, therefore be it

Resolved, That the United Boiler Makers and Iron Ship Builders of North America in convention assembled most heartily indorses the Merchant Marine Commission shipping bill, and most earnestly urges upon every representative in congress his active and patriotic support of that measure, as in the interest of the national defense, for the greater stability of our foreign carrying, and as in the interest of American labor; and be it further

Resolved, That a copy of these resolutions be forwarded to the chairman of the House Merchant Marine and Fisheries Committee, over the seal of this association and the attestation of the secretary.

(seal) Attest: (signed) N. P. FITZHENRY,
JNO. J. SWEENEY, N. S. T. Nat. Pres.

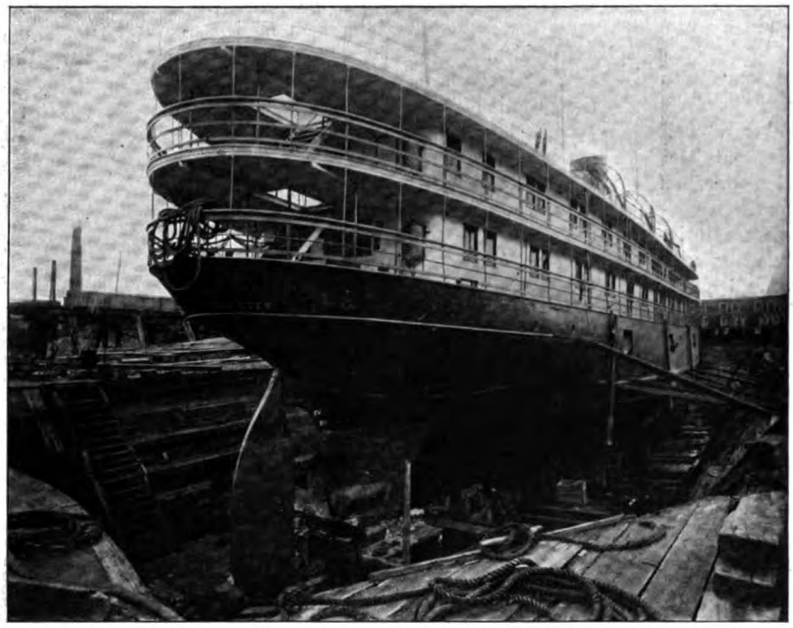
The Pennsylvania Railroad Co. has awarded contract to the Burlee Dry Dock Co., Port Richmond, Staten Island, for eight steel barges 100 ft. long, 34 ft. beam and 10 ft. deep for harbor service.

The Sun Oil Co. of Philadelphia has given contract to the Newport News Ship Building & Dry Dock Co. for a tank steamer 400 ft. long and designed for a speed of 10 knots.

Percy & Small, Bath, Me., have begun work on a six-masted schooner for J. S. Winslow & Co., of Portland, Me.

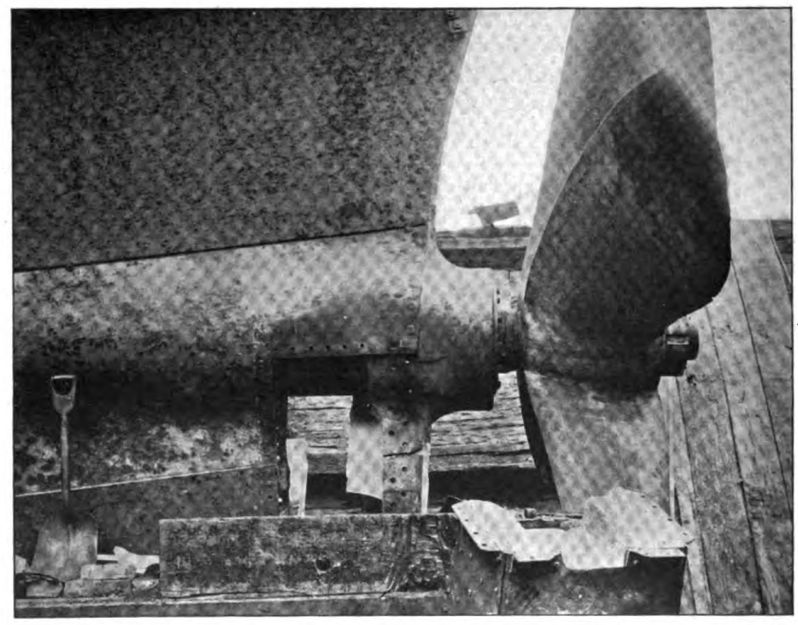
THERMIT REPAIRS ON STEAMER PURITAN.

The following report of repairs to the steamer Puritan, of the Graham & Morton Transportation Co.'s fleet, through the use of Thermit at the yard of the Ship Owners Dry Dock Co., Chicago, recently, is of much interest.



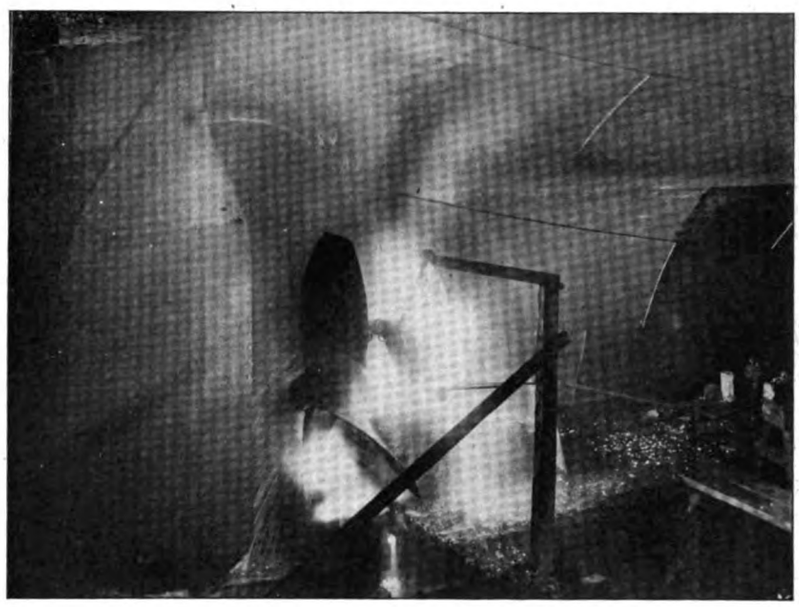
THE PURITAN IN DRY DOCK AT THE YARD OF THE SHIP OWNERS' DRY DOCK CO.

The vessel was docked at 3 A. M., April 12. At 8 A. M. the water had been pumped out and the work for the removal of the parts of two sheets, which are fully illustrated in the photographs, was commenced. These portions of the hull plating were removed to enable the workmen to get around the stern post and also to make room for the mold box. The stern post was found to be broken about 7 in. below the "boss," as shown, there having been placed two holes directly in line through the transverse section of the stern post when the vessel was originally constructed. This so weakened the section as to cause it to break at this point. The fracture was cut out by drilling a series of transverse holes ⅞ in. in diameter, then removing the metal between the holes until a clear passage, ⅞ in. wide, was obtained between the two ends of the fractured stern post. The surface of the stern frame or post was very carefully cleaned off with edge tools, so as to have the parts to be welded perfectly clean and bright. The mold box was prepared as will be further described and the stern post was heated to as high a temperature as could be obtained with charcoal and coke fire without injury to the stern bearing. The fire was started at 6 A. M. and was continued until about 2 P. M., when the fire was removed and the mold box brought from the oven and put in place. The mold box had been so carefully arranged that practically no fitting was necessary, and went to its place or position without any difficulty. The joints were very carefully luted with sheet asbestos and asbestos wick—this in turn being protected by heavy reinforcements of fire clay. A platform was built up around the stern frame, as will be shown in illustrations, upon which was built a brick foundation and a pit was formed with brick, into which sand was dumped, the sand being thoroughly packed in around the post, to a height equal to the top of the weld. These precautions were taken so as to provide against leakages and to preserve the weld in case of leaks. By this time it was found that the mold box and stern frame were still quite hot. Further preheating was practically dispensed with. A large gasoline torch had been provided with a nozzle about two inches in diameter. This torch provided a very hot flame, which was directed into the risers of the mold box and continued for about one-half an hour. In the meantime the crucible had been heated to a red heat and was put into position and charged. 420 lbs. of Thermit were used and a supply of 84 lbs. of rivets, ranging from ⅝ in. to ⅞ in. in diameter and from 1 in. to 2 in. in length. These were heated red-hot and thoroughly mixed in the Thermit. Two per cent of pulverized manganese was carefully mixed in with the mixture and the whole was then set off. The reaction and the pouring of the metal consumed about one minute and a half. At about 11 P. M. the mold box was removed, and it was found that the weld was perfect. The illustrations of the frame before and after the weld and also the finished product fully demonstrate the success of the operation. At 7 A. M. the following day the iron workers proceeded to trim off the gate and risers and the work and drilling of the stern frame and also the replacing of the sheets continued until 5 P. M., April 18, after which the boat was put into the water. The actual work of the weld, from the time the sheets were removed until the weld was made, consumed 3 days. This included the baking of the mold, which in this instance required about 35 hours.



THE BREAK THROUGH THE STERN POST.

Thermit used	420 lbs.
Rivets (estimated)	84 lbs.
Manganese	2 per cent
Cross section before welding	4 x 7
Cross section after welding	7 x 11



THERMIT REACTION.

NAVAL PROGRAM.

The naval bill as submitted to congress by Representative Foss, chairman of the naval committee, carries an appropriation of $99,734,215.77, of which $13,250,000 is for new construction. The program outlined is as follows:

"One first class battleship, carrying as heavy armor and as powerful armament as any known vessel of its class, to have the highest practicable speed and greatest practicable radius of action, and to cost, exclusive of armament and armor, not exceeding $6,000,000 provided that before approving any plans or specifications for the construction of such battleship the secretary of the navy shall afford, by advertisement or otherwise, in his discretion, a reasonable opportunity to any competent constructor who may desire so to do to submit plans and specifications for his consideration, for which plans, should the same be used by the department and be not submitted by or on behalf of a successful bidder for the contract, such compensation shall be paid as the secretary of the navy shall deem just and equitable out of the amount herein appropriated under the head of 'contingent, navy'.

"Three torpedo boat destroyers, to have the highest practicable speed, to cost, exclusive of armament, not to exceed $750,000 each.

"The secretary of the navy is hereby authorized in his discretion to contract for or purchase subsurface or submarine torpedo boats to an amount not exceeding $1,000,000, after such competitive tests as he shall see fit to prescribe to determine the comparative efficiency of the different boats for which bids may be submitted. Provided, that such competitive tests shall take place within six months from the date of the passage of this act."

Regarding the proposed increase the report says:

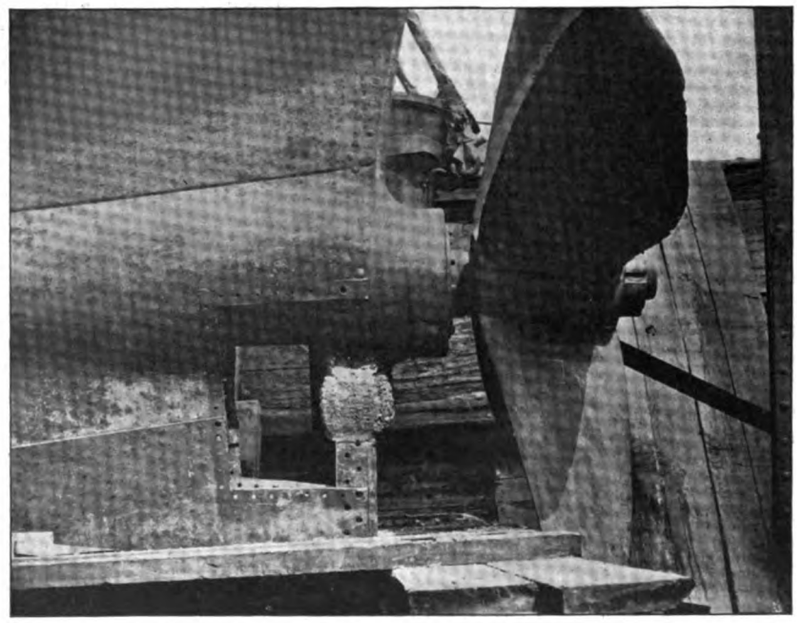
"The cost of such a program as above recommended would be one battleship (estimated) at $10,000,000, three torpedo boat destroyers, $2,250,000, and subsurface, submergible marine boats, $1,000,000; in all $13,250,000.

"The great naval powers of the world are building battleships of greater tonnage. England has recently launched the Dreadnought, a ship of nearly 19,000 tons. Japan is building one of even larger tonnage, and Germany has recently increased the tonnage of some of her ships heretofore authorized to 18,000 tons.

"The secretary of the navy recommends that if congress should authorize but one battleship this year 'it shall be the largest and strongest battleship that is known to be afloat.'

"The committee recommend three torpedo boat destroyers, cost not to exceed $750,000 each.

"The committee further recommends that the secretary be authorized in his discretion to contract for or purchase subsurface or submarine torpedo boats to an amount not to exceed $1,000,000 after such competitive tests as he shall see fit to prescribe. The purpose of this is to give the secretary of the navy full and complete latitude to secure the best boats and to give every manufacturer of said boats a fair and square deal. The committee recommends that the limit of cost of the battleship Connecticut, authorized by act of congress approved July 1, 1902, be increased to $4,600,000. This is an increase of $380,000 over the limit of cost provided for in the original act, and is made necessary by the increased cost of construction in navy yards. The committee further recommends that the limit of cost of each of the two training vessels authorized by act of congress approved March 3, 1903, be increased



THE WELDED STERN POST.

$410,000. This is an increase of $40,000 each over that originally provided for. These ships are also being built in navy yards. The committee further recommends that the limit of cost of each of the colliers authorized by act of April 27, 1904, be increased to $1,550,000. This is an increase of $300,000 each. In said act it was provided that the colliers shall be built in the navy yards, one on the Pacific and the other on the Atlantic coast, and the additional cost is due largely, if not entirely, to the increased cost of government construction."

REDUCING FRICTION ONE-THIRD.

That the use of a limpid oil with graphite will reduce friction to one-third that of the rolling bearing seems to be justified by the following:

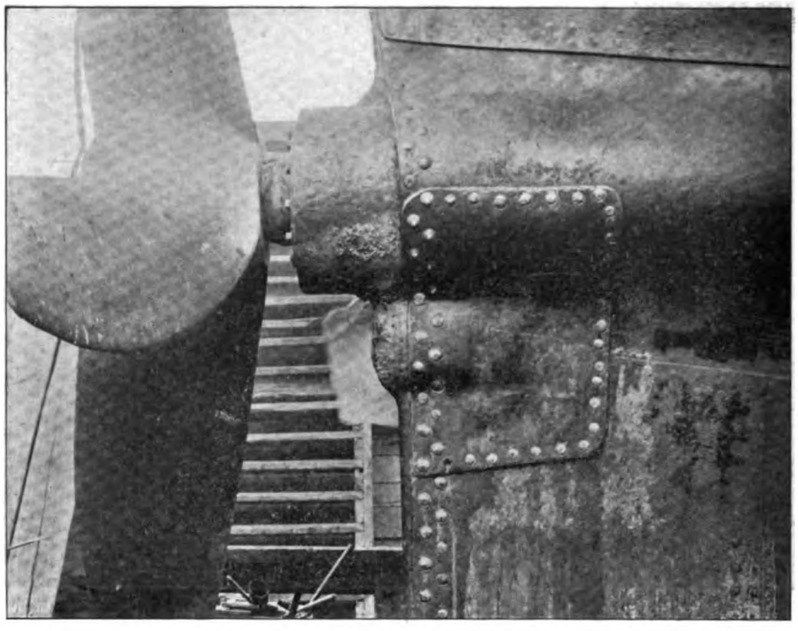
The October, 1905, issue of *Machinery*, contains a report of a series of tests on roller bearings, made by Prof. C. H. Benjamin, at the Case School of Applied Science, which are of especial interest in view of certain results which have been obtained by Prof. Goss, from plain bearings lubricated with kerosene and Dixon's flake graphite.

Prof. Benjamin's experiments were made upon several different kinds and sizes of roller bearings in common use. The purpose of the experiments was to determine the friction developed by such bearings when run under different conditions of load and speed. The apparatus employed was similar to the well-known Thurston oil testing machine, and was in every way well adapted to the purpose for which it was used. Prof. Benjamin's reputation as an experimenter, and the highly refined character of the apparatus he employed, leave no question as to the accuracy of his work.

In the results which were obtained by Prof. Benjamin from the use of roller bearings 1 15-16 in. in diameter, in comparison with those obtained from the step bearing testing machine made use of by Prof. Goss in connection with his study of graphite under similar conditions of pressure, it was demonstrated that the coefficient of friction developed by the roller bearings was greatly in excess of that developed by the use of graphite and kerosene in a step bearing. Thus, when the pressure is 40 lbs. per sq. in., the coefficient of friction for the graphite and kerosene is 0.00459, while the average coefficient for the two roller bearings is 0.018, or 3.92 times greater. When the pressure is 50 lbs. per sq. in., the coefficient of friction for the graphite and kerosene is 0.00442, and for the roller bearing 0.0175, or 3.95 times greater. There are no conditions which can impair the value of this comparison except that a higher speed was employed with the roller bearing than with that which was lubricated. But as the coefficient of friction of the lubricated journal generally diminishes with increase of speed, a correction of this would make the differences in results greater. The step bearing was able to carry a load of 110 lbs. per sq. in., while the greatest load carried by the roller bearing was 61 lbs. per sq. in., or only 55.5 per cent as much as that of the step.

Prof. Benjamin also made tests of plain bearings and found that "the friction of roller bearings is less than that of plain bearings."

There is no secret in all this. The plain bearings experimented on by Prof. Benjamin were undoubtedly lubricated with an oil possessing considerable body, whereas in the presence of graphite a very light oil will suffice. The friction of lubricated journals is largely a matter of viscosity of the lubricant. For any given service, the use of graphite will always present a reduction in the viscosity of the liquid lubricant and hence a reduction in friction. The extent to which such a change may be carried is, however, not commonly recognized. It is well illustrated by the fact that a graphitic mixture, well designed for the service expected of it, gave results which leave the roller bearing quite distanced in the race.—May *Graphite*.



THE PURITAN READY FOR SERVICE.

LAUNCHING OF THE BRASILIA.

The latest addition to the fleet of the Hamburg-American Co. was made on Tuesday, April 24, when there was launched at Yarrow, from the yard of Palmer's Ship Building & Iron Co., a large steel screw steamer named Brasilia. The principal dimensions of the vessel are: Length 450 ft., breadth molded, 53 ft., and depth molded to upper deck, 34 ft., 6 in. She has been built to obtain the highest class in the Germanischer-Lloyds, and is rigged as a four-masted fore-and-aft schooner. The Brasilia has two steel decks laid all fore and aft, the upper deck, where exposed, being sheathed with pitch pine. The poop is 28 ft. long, and contains large ice-house and store rooms. A bridge is fitted amidships, 120 ft. long, covering the machinery openings and left clear for carrying cargo and bunkers. On the bridge deck accommodation is fitted in steel deck-houses for the captain, officers, and engineers, while the seamen, firemen and petty officers are berthed in the top gallant forecastle, which is 41 ft. long. The vessel is subdivided by seven watertight steel bulkheads, and has cellular double-bottom all fore-and-aft for water ballast, additional water ballast also being provided for in a deep tank abaft the engine room bulkhead, and in fore and aft peaks. The steamer is to be fitted with 24 steel derricks, and one special derrick to lift 25 tons, as well as a large outfit of winches for the rapid manipulation of cargoes. She will also have electric light throughout. The vessel is to be fitted with quadruple-expansion engines having cylinders 25½, 36½ and 52 inches and 75 inches in diameter, by 51-inch stroke. The Brasilia has carrying capacity of over 10,000 tons dead weight.

Mr. Edward F. Daly has been appointed general passenger agent of the Chicago & Milwaukee line.

WANTED and FOR SALE Department.

PROPOSALS.

U. S. Engineer Office, Buffalo, N. Y., April 20, 1906.—Sealed proposals in triplicate for construction of stone breakwater at South Harbor Entrance, Buffalo, N. Y., will be received here until 11 A. M. May 21, 1906, and then opened. Information furnished on application. H. M. ADAMS, Col. Engrs.

U. S. Engineer Office, Jones Building, Detroit, Mich., April 14, 1906. Sealed proposals for dredging Round Island Shoals, St. Marys River, Mich., will be received at this office until 2 p. m. May 14, 1906, and then publicly opened. Information furnished on application. CHAS E. L. B. DAVIS, Col., Engrs.

WANTED

Engines

WANTED: Fore and Aft Compound Engine not less than 20″ x 40″ x 30. One Double High Pressure Engine not less than 20″ x 24″. Address 583 14th Ave, Detroit, Mich.

FOR SALE.

Steamer Hazel.

For sale at Grand Haven, Michigan, the passenger and freight steamer "Hazel." Length 93 ft, beam 18 ft, draft about 7′ 6″. For further particulars address

MRS. R. B. RICE,
157 4th st., Muskegon, Mich.

FOR SALE.

For Sale.

1,000 h. p. fore and aft Neafie & Levy compound Engine; surface condenser; independent pumps.
Two 12 foot Scotch Boilers.
One 13½ foot Scotch Boiler.
One 10 16-25 x 16 triple expansion Engine.
Three 50 h. p. Almy Boilers.
One 200 h. p. Tregurtha Boiler.
One 14 30 x 24 fore and aft Engine and condenser.
One Williamson steering Engine.
One 10 k. w. electric lighting Set.
One 15 k. w. electric lighting Set.
One Providence Windlass, 50 fathoms 1½ in. chain.
Two thrust Shafts and Bearings, 8½ in. diameter.

MARVIN BRIGGS,
17 Battery place, New York, N. Y.

A Bargain.

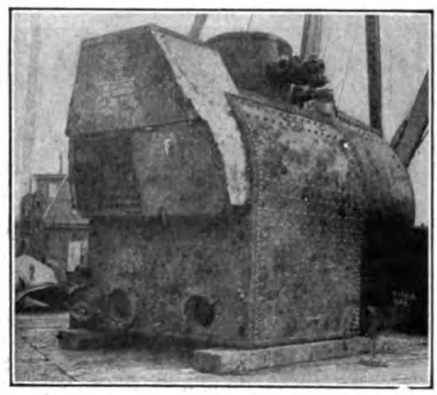
Steamer E. F. Gould, length 137 ft., width 28 ft, depth 8 ft. 5 in, tonnage 261 tons. Boiler, engine and hull in good condition. First-class, complete sand pumping outfit now installed on boat, will sell with boat if so desired. Apply

JOHN M. McKERCHEY,
Detroit, Mich.

For Sale.

Five Scotch Boilers, allowed 160 lbs. steam. Good as new. ERIE MACHINERY CO., 729 Garfield Bldg., Cleveland, O.

FOR SALE.



FOR SALE.

Boiler about 1 year old, good order, 9 ft. 5 in. face, 13 ft. long, 125 pounds steam.

MERRITT & CHAPMAN
DERRICK & WRECKING CO.,
17 Battery Place, N. Y.

Marine Railway

FOR SALE.—Marine Railway 1,000 tons capacity, Boat Railway, 45 rods land, about 170 feet water front buildings. Two boilers, one is new, machinery and sawmill, etc. ABRAM CHACE, 507 Kempton St,, New Bedford, Mass.

Bankruptcy Sale.

Estate of Stang & Little, Contractors.

The undersigned is offering for sale the complete outfit of the above firm, consisting of Dredge, Scows, Pile Drivers, etc. Plant can be seen at Lorain, Ohio.

W. N. LITTLE, Trustee in Bankruptcy.

Buyers' Directory of the Marine Trade

For a more complete classification than that represented by advertisers in the Marine Review, see the BLUE BOOK OF AMERICAN SHIPPING, marine and naval directory of the United States, published by The Marine Review, Cleveland.

See accompanying index of Advertisers for full addresses of concerns in this directory.

AIR COMPRESSORS, AIR HOISTS, ETC.
Great Lakes Engineering Works.....Detroit.

AIR PORTS, DEAD LIGHTS, ETC.
Marine Mfg. & Supply Co.....New York.

AIR PUMPS AND APPLIANCES.
Fore River Ship & Engine Co..Quincy, Mass.
Great Lakes Engineering Works.....Detroit.

ANCHORS.
Bowers, L. M. & Co.....Binghamton, N. Y.

ANTI-FRICTION METALS.
Cramp, Wm. & Sons.....Philadelphia.

ARTIFICIAL DRAFT FOR BOILERS.
American Ship Building Co.....Cleveland.
Detroit Ship Building Co.....Detroit
Great Lakes Engineering Works.....Detroit

ASH EJECTORS.
Great Lakes Engineering Works.....Detroit.

ATTORNEYS AND PROCTORS IN ADMIRALTY.
Gilchrist, Albert J.....Cleveland.
Goulder, Holding & Masten.....Cleveland.
Hoyt, Dustin & Kelley.....Cleveland.
Jenkins, Russell & Eichelberger....Cleveland.
Kremer, C. E.....Chicago.
MacDonald, Ray G.....Chicago.
Shaw, Warren, Cady & Oakes.....Detroit.
White, Johnson, McCaslin & Cannon Cleveland

BAROMETERS, MARINE GLASSES, ETC.
Ritchie, E. S. & Sons.....Brookline, Mass.

BELTING (LEATHER).
Republic Belting & Supply Co.....Cleveland.

BLOCKS, SHEAVES, ETC.
Boston & Lockport Block Co.....Boston, Mass.
Cleveland Block Co.....Cleveland.

BOAT BUILDERS.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, David.....New York.
Marine Construction & D. D. Co.....
.....Mariner's Harbor, S. I., N. Y.
Truscott Boat Mfg. Co....St. Joseph, Mich.

BOILER COMPOUNDS.
The Bird-Archer Co..... New York
Dearborn Drug & Chemical Works....Chicago.
State Manufacturing Co.....Cleveland.

BOILER MANUFACTURERS.
Almy Water Tube Boiler Co..Providence, R. I.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Chicago Ship Building Co.....Chicago.
Cramp, Wm. & Sons.....Philadelphia.
Dearing Water Tube Boiler Co.....Detroit.
Detroit Ship Building Co.....Detroit.
East End Boiler Works.....Detroit.
Fletcher, W. A. & Co.....Hoboken, N. J.
Fore River Shipbuilding Co.....Quincy, Mass.
Great Lakes Engineering Works.....Detroit.
Kingsford Foundry & Machine Works....
.....Oswego, N. Y.
Maryland Steel Co.....Sparrows Point, Md.
Milwaukee Dry Dock Co.....Milwaukee.

BOILER MANUFACTURERS—Continued.
Mosher Water Tube Boiler Co....New York.
Newport News Ship Building Co.....
.....Newport News, Va.
New York Shipbuilding Co.....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co....
.....Duluth, Minn.
Quintard Iron Works Co.....New York.
Roberts Safety Water Tube Boiler Co....
.....New York.
Superior Ship Building Co....Superior, Wis.
Taylor Water Tube Boiler Co.....Detroit.

BOILER RIVETS.
Bourne-Fuller Co.....Cleveland.

BOILER STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co..Cuyahoga Falls, O.

BRASS AND BRONZE CASTINGS.
Cramp, Wm. & Sons.....Philadelphia.
Fore River Ship & Engine Co..Quincy, Mass.
Great Lakes Engineering Works.....Detroit.
Lunkenheimer Co.....Cincinnati.

BRIDGES, BUILDERS OF.
Scherzer Rolling Lift Bridge Co.....Chicago.

BUCKETS, ORE AND COAL.
Brown Hoisting & Conveying Machine Co.
..... Cleveland.

CABIN AND CABINET FINISHING WOODS.
Martin-Barriss Co.....Cleveland.

CANVAS SPECIALTIES.
Baker & Co., H. H.....Buffalo.
Bunker, E. A. .....New York.
Upson-Walton Co.....Cleveland.
Republic Belting & Supply Co.....Cleveland.

CAPSTANS.
American Ship Windlass Co..Providence, R. I.
Dake Engine Co.....Grand Haven, Mich.
Hyde Windlass Co.....Bath, Me.
Marine Mfg. & Supply Co.....New York.

CEMENT, IRON FOR REPAIRING LEAKS.
Smooth-On Mfg. Co.....Jersey City, N. J.

CHAIN CONVEYORS, HOISTS.
Brown Hoisting Machinery Co. (Inc.)....
..... Cleveland.
General Electric Co.....Schenectady, N. Y.

CHAIN HOISTS.
Boston & Lockport Block Co....Boston, Mass.
Republic Belting & Supply Co.....Cleveland, O.

CHARTS.
Penton Publishing Co.....Cleveland.

CLOCKS (Marine and Ship's Bell) AND CHRONOMETERS.
Ritchie, E. S. & Sons.....Brookline, Mass.

COAL PRODUCERS AND SHIPPERS.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.

COAL AND ORE HANDLING MACHINERY.
Brown Hoisting Machinery Co. (Inc.)....
..... Cleveland.

COMPASSES.
Ritchie, E. S. & Sons.....Brookline, Mass.

CONDENSERS.
Great Lakes Engineering Works.....Detroit
Thropp & Sons Co., John E...Trenton, N. J.

CONTRACTORS FOR PUBLIC WORKS.
Breymann & Bros., G. H.....Toledo.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co.....Buffalo.
Graves & Stephens..... Cleveland.
Great Lakes Dredge & Dock Co.....Chicago.
Hickler Bros.....Sault Ste. Marie, Mich.
Hubbell Co., H. W.....Saginaw, Mich.
Smith Co., L. P. & J. A.....Cleveland.
Starke Dredge & Dock Co., C. H..Milwaukee.
Standard Contracting Co..... Clevelnad
Sullivan, M.....Detroit.

CORDAGE.
Baker & Co., H. H.....Buffalo.
Upson-Walton Co.....Cleveland.

CORK JACKETS AND RINGS.
Armstrong Cork Co.....Pittsburg, Pa.
Kahnweiler's Sons, D.....New York.

CRANES, TRAVELING.
Brown Hoisting Machinery Co.....Cleveland.

DIVING APPARATUS.
Morse, A. J. & Son.....Boston.
Schrader's Son, Inc., A..... ... New York.

DREDGING CONTRACTORS.
Breymann & Bros., G. H.....Toledo.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co.....Buffalo.
Great Lakes Dredge & Dock Co.....Chicago.
Hickler Bros.....Sault Ste. Marie, Mich.
Hubbell Co., H. W.....Saginaw, Mich
Smith Co., L. P. & J. A.....Cleveland.
Starke Dredge & Dock Co., C. H..Milwaukee.
Sullivan, M.....Detroit.

DREDGING MACHINERY.
Quintard Iron Works Co.....New York.

DRY DOCKS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Buffalo Dry Dock Co.....Buffalo.
Chicago Ship Building Co.....Chicago.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Ship Building Co.....Detroit.
Great Lakes Engineering Works.....Detroit.
Lockwood Mfg. Co.....East Boston, Mass.
Milwaukee Dry Dock Co.....Milwaukee.
Newport News Ship Building Co.....
.....Newport News, Va.
Shipowners Dry Dock Co.....Chicago.
Superior Ship Building Co....Superior, Wis.
Tietjen & Lang Dry Dock Co.....Hoboken, N.J.

DREDGE BUILDERS.
Manitowoc Dry Dock Co.....Manitowoc, Wis.

DYNAMOS.
General Electric Co.....Schenectady, N. Y
Thropp & Sons, John E.....Trenton, N. J.

ELECTRIC HOISTS AND CRANES.
General Electric Co.....Schenectady, N. Y.

Buyers' Directory of the Marine Trade.—*Continued.*

ELECTRIC LIGHT AND POWER PLANTS.
General Electric Co.....Schenectady, N. Y.
Thropp & Sons, John E.....Trenton, N. J.

ENGINE BUILDERS, MARINE.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Chicago Ship Building Co.....Chicago.
Chase Machine Co.....Cleveland.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Ship Building Co.....Detroit.
Fletcher, W. & A. Co.....Hoboken, N. J.
Fore River Shipbuilding Co....Quincy, Mass.
Great Lakes Engineering Works.Detroit, Mich.
Hall Bros. .....Philadelphia.
Lockwood Mfg. Co.....East Boston, Mass.
Maryland Steel Co.....Sparrows Point, Md.
Milwaukee Dry Dock Co.....Milwaukee.
Mosher, Chas. D.....New York.
Newport News Ship Building Co.....
.....Newport News, Va.
New York Shipbuilding Co....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co...
..... Duluth, Mich.
Quintard Iron Works Co.....New York.
Roach's Ship Yard.....Chester, Pa.
Sheriffs Mfg. Co.....Milwaukee.
Superior Ship Building Co....Superior, Wis.
Thropp, J. E. & Sons Co.....Trenton, N. J.
Trout, H. G.....Buffalo.

ENGINE ROOM TELEGRAPH, CALL BELLS, ETC.
Cory, Chas. & Son.....New York.
Marine Mfg. Supply Co.....New York.

ENGINEERING SPECIALTIES AND SUPPLIES.
Lunkenheimer Co. .....Cincinnati.
Northwestern Steam Boiler & Mfg. Co...
..... Duluth, Minn.

ENGINEERS, MARINE, MECHANICAL, CONSULTING.
Hynd, Alexander .....Cleveland.
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Kidd, Joseph.....Duluth, Minn.
Mosher, Chas. D.....New York.
Nacey, James .....Cleveland.
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Wood, W. J. .....Chicago.

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Greacen-Derby Engineering Co.....
.....Perth Amboy, N. J.
Ross Valve Co.....Troy, N. Y.

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General Electric Co.....Schenectady, N. Y.

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Sutton Co., C. E.....Toledo, O.

FORGINGS FOR CRANK, PROPELLER OR THRUST SHAFTS, ETC.
Cleveland City Forge & Iron Co...Cleveland.
Fore River Shipbuilding Co.....Quincy, Mass.
Macbeth Iron Co.....Cleveland.

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Fix's, S. Sons.....Cleveland.

FUELING COMPANIES AND COAL DEALERS.
Hanna, M. A. & Co.....Cleveland.
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Parker Bros. Co., Ltd.....Detroit.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.
Smith, Stanley B., & Co.....Detroit.

FURNACES FOR BOILERS.
Continental Iron Works.....New York.

GAS BUOYS.
Safety Car Heating & Lighting Co..New York.

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Chase Machine Co.....Cleveland.

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Lunkenheimer Co. .....Cincinnati.

GAUGES, WATER.
Lunkenheimer Co. .....Cincinnati, O.

GENERATING SETS.
General Electric Co.....Schenectady, N. Y.

GRAPHITE.
Dixon Crucible Co., Joseph..Jersey City, N. J

GREASE EXTRACTORS.
Greacen-Derby Engineering Co.....
.....Perth Amboy, N. J.

HAMMERS, STEAM.
Chase Machine Co.....Cleveland.

HEATING APPARATUS.
Sutton Co., C. E.....Toledo, O.

HOISTS FOR CARGO, ETC.
American Ship Building Co.....Cleveland.
Brown Hoisting Machinery Co. (Inc.)....
..... Cleveland.
Chase Machine Co.....Cleveland.
Dake Engine Co..... Grand Haven, Mich.
General Electric Co.....New York.
Georgian Bay Engineering Works.....
.....Midland, Ont.
Hyde Windlass Co.....Bath, Me.
Marine Iron Co.....Bay City.

HOLLOW SHAFTINGS, IRON OR STEEL.
Falls Hollow Staybolt Co...Cuyahoga Falls, O.

HOLLOW STAYBOLT IRON.
Falls Hollow Staybolt Co...Cuyahoga Falls, O.

HYDRAULIC DREDGES.
Great Lakes Engineering Works.....Detroit.

HYDRAULIC TOOLS.
Watson-Stillman Co., The.....New York.

ICE MACHINERY.
Great Lakes Engineering Works.....Detroit.
Roelker, H. B.....New York.

INJECTORS.
American Injector Co.....Detroit.
Jenkins Bros. .....New York.
Lunkenheimer Co.....Cincinnati.
Penberthy Injector Co.....Detroit, Mich.

INSURANCE, MARINE.
Elphicke, C. W. & Co.....Chicago.
Fleming & Co., E. J.....Chicago.
Gilchrist & Co., C. P.....Cleveland.
Hawgood & Co., W. A.....Cleveland.
Helm & Co., D. T.....Duluth.
Hutchinson & Co.....Cleveland.
McCarthy, T. R.....Montreal.
McCurdy, Geo. L.....Chicago.
Mitchell & Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Peck, Chas. E. & W. F..New York & Chicago.
Prindiville & Co.....Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.

IRON CASTINGS.
Sutton Co., C. E.....Toledo, O.

IRON ORE AND PIG IRON.
Bourne-Fuller Co.....Cleveland, O.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.

LAUNCHES—STEAM, NAPHTHA, ELECTRIC.
Truscott Boat Mfg. Co.....St. Joseph, Mich.

LIFE PRESERVERS, LIFE BOATS, BUOYS.
Armstrong, Cork Co.....Pittsburg.
Carley Life Float Co .....New York, N. Y.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, D.....New York.

LIGHTS, SIDE AND SIGNAL.
Russell & Watson .....Buffalo.

LOGS.
Nicholson Ship Log Co.....Cleveland.
Walker & Sons, Thomas....Birmingham, Eng.
Also Ship Chandlers.

LUBRICATING GRAPHITE.
Dixon Crucible Co., Joseph..Jersey City, N. J.

LUBRICATORS.
Lunkenheimer Co. .....Cincinnati

LUMBER.
Martin-Barriss Co.....Cleveland.

MACHINISTS.
Chase Machine Co.....Cleveland.
Hickler Bros.....Sault Ste. Marie, Mich.
Lockwood Mfg. Co.....East Boston, Mass.

MACHINE TOOLS (WOOD WORKING).
Atlantic Works, Inc.....Philadelphia.

MARINE RAILWAYS.
Hickler Bros.....Sault Ste. Marie, Mich.

MARINE RAILWAYS, BUILDERS OF.
Crandall & Son, H. I.....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W.....New York.

MECHANICAL DRAFT FOR BOILERS.
American Ship Building Co.....Cleveland.
Detroit Ship Building Co.....Detroit.
Great Lakes Engineering Works.....Detroit.

METALLIC PACKING.
Katzenstein, L. & Co.....New York.
The National Metallic Packing Co....Oberlin, O.

MOTORS, GENERATORS—ELECTRIC
General Electric Co.....Schenectady, N. Y.

NAUTICAL INSTRUMENTS.
Benjamin Farnum How.....Boston
Ritchie, E. S., & Sons.....Brookline, Mass.

NAVAL ARCHITECTS.
Hynd, Alexander .....Cleveland.
Kidd, Joseph .....Duluth, Minn.
Mosher, Chas. D.....New York.
Nacey, James .....Cleveland.
Wood, W. J. .....Chicago.

OAKUM.
Stratford, Oakum Co.....Jersey City, N. J.

OIL ENGINES.
Mietz, Aug. .....New York.

OILS AND LUBRICANTS.
Dixon Crucible Co., Joseph..Jersey City, N. J.
Standard Oil Co.....Cleveland.

PACKING.
Jenkins Bros. .....New York.
Katzenstein, L. & Co.....New York.
The National Metallic Packing Co....Oberlin, O.
Republic Belting & Supply Co.....Cleveland, O.

PAINTS.
Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co. .....Cleveland.

PATTERN SHOP MACHINERY.
Atlantic Works, Inc.....Philadelphia.